Dec. 1928

Electrical Manufacturing

Vol. 2 A Gage Publication No. 6

Craftsmen with thirty years of molding experience . . . and proud of their profession . . . zealously supervise the production of every part.

Now- a complete BAKELITE service

....manned by experts in the molding of custom-built parts

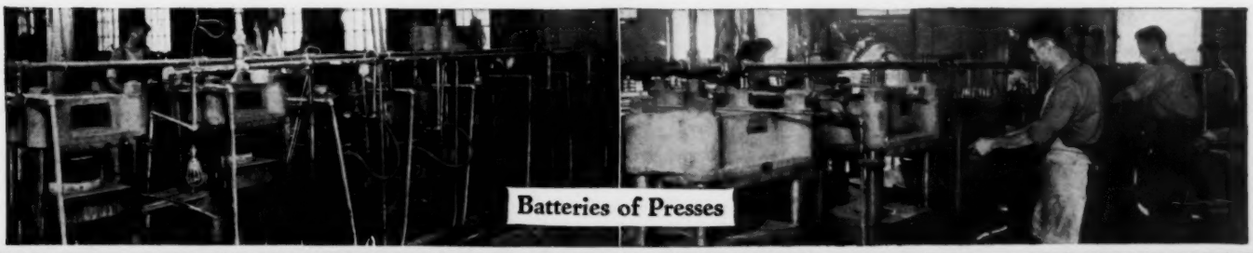
As specialists in the manufacture of molded parts, built to custom, we take keen pleasure in announcing the addition of a complete molded BAKELITE service.

This new BAKELITE Department has been created at the urgent and repeated request of *our own customers.* Highly pleased with the intelligent service they have come to expect of us in supplying their requirements in the molding of genuine hard rubber parts, they have asked that our service be broadened to include this equally important field of plastics.

In offering these new facilities to our friends in the trade we guarantee the same high standards of skilled craftsmanship and exact attention to detail that have won for us our present position of leadership in the field of genuine hard rubber.

Let us quote you on your next requirements.

The VULCANIZED RUBBER COMPANY, *Inc.*
Makers of Genuine BAKELITE and HARD RUBBER PRODUCTS
251 Fourth Avenue New York



Batteries of Presses

Byrd's Trans-Atlantic Fokker — Fokker used in U. S. to Australia Flight — Maitland's Pacific Flight Plane

Mears and Collyer Round-the-World Plane — U. S. Air Corps Keystone Pirate Bomber — U. S. Air Corps Curtiss Bombing Plane

U. S. Air Corps Standard DeHaviland 4's — U. S. Airship RS-1 — U. S. Army Curtiss Plane used in Nicaragua

Lindbergh's New Ryan Monoplane — Chicago-San Francisco Mail Plane

A Tribute to Belden Quality

PERHAPS the supreme test of any equipment is airplane service where failure of even the most insignificant part frequently means disaster.

In airplane service vibrations, sudden changes in temperature, and all manner of stresses and strains impose upon electrical cable the severest possible duty.

It is significant that Belden Airplane Wires and Cables have been used on nearly every American plane that has achieved great renown. A few of these famous planes are shown in the illustration.

The accurate manufacturing practices which have made Belden Wires and Cables suitable for exacting airplane service guarantee a uniformly high quality in other Belden Materials.

Write for complete information covering Belden Products in which you are interested.

BELDEN PRODUCTS

Beldenamel and Textile Magnet Wire
Coil Windings
Beldenmold (Molded Bakelite Products)
Automotive Wires and Cables
Airplane Assemblies
Radio Wires, Cords and Cables
Rubber Covered Wires
Armored Cables
Flexible Armature Wires
Motor Lead Wires
Braided and Stranded Copper Cables
Cotton Sleeving

Belden Manufacturing Company
2310-B South Western Avenue **Chicago, Illinois**

Specify Belden

Rising to the needs of a Great Industry

The requirements of the electrical industry are more and more exacting.

As electrical products improve, coils must be more accurate to keep pace with the fine calibrations of the electrical engineer.

This is why the world's most successful radio manufacturers in the electrical, ignition and radio fields turn to Dudlo for coils.

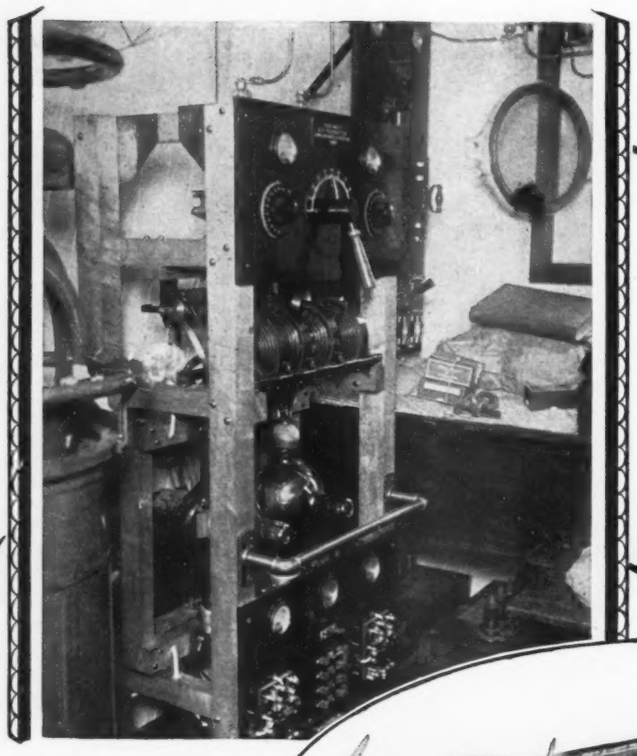
Dudlo coils are not only wound accurately, but every part and material from the core to the outside wrapping is selected and applied with skill; a skill which could only come from an organization trained over many years of making millions upon millions of coils for every electrical need.

The Coil's the thing!

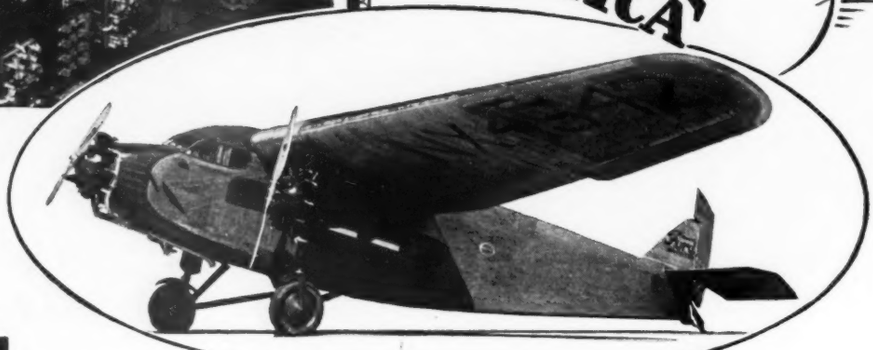
No electrical unit is better than its coil, and no coil is any better than the wire in its windings. Dudlo draws and insulates the wire and controls every part and process from the copper rod to the finished coil. A complete service to the electrical industries.

DUDLO MANUFACTURING COMPANY, FORT WAYNE, INDIANA

56 Earl St., Newark, N. J. | 105 W. Adams St., Chicago, Ill. | Division of THE GENERAL CABLE CORPORATION | 274 Brannan St., San Francisco, Cal. | 4143 Bingham Ave., St. Louis, Mo.



BYRD'S RADIO is insulated with FORMICA



FORMICA was used by the engineers who designed the sending and receiving apparatus in use by the expedition for panels, tubing and other insulating parts.

For fifteen years American radio men have known it as excellent insulation for high or low frequency uses. It is high in quality and uniform - - - Phenol Fibre at its best.

Every year millions of automotive ignition systems, therapeutic apparatus, circuit breakers and electrical devices of all kinds are insulated with Formica. You can depend upon it.

THE FORMICA INSULATION CO.
4638 Spring Grove Avenue Cincinnati, Ohio

FORMICA
Made from Anhydrous Bakelite Resins
SHEETS TUBES RODS

Electrical Manufacturing

Reg. U. S. Patent Office

• Production • Marketing • Administration • Repairing •

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Volume 2 | DECEMBER, 1928 | Number 6

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"Where Do I Go from Here?"

By WILLIAM R. BASSET

THE more farsighted business men are beginning to realize that the permanent success of their businesses depends not only on the actual methods which they use but also on the trends and events which may, at first glance, seem rather remote from their interests. In increasing numbers they are going to ask the editors of their business papers to interpret for them in terms of their specific needs the ultimate effects which may be expected from both industrial and political happenings in other industries and in other countries.

For example, many thoughtful men are now studying carefully to determine what may be the effect of the rapid development of the airplane. It is not only the man who makes something that may conceivably be used by the airplane manufacturer who is studying this problem. Other business men are asking whether the airplane will affect their businesses.

Developments in many fields during recent years have had almost revolutionary effects on seemingly unrelated businesses. The point that I am trying to make is that there is nothing within the realm of present or future knowledge which may not be of vital importance to any business man. The speed with which business will progress and general prosperity increase will depend to a large extent upon the ability of the average business man to foresee these changes and adapt himself to them.

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461 Eighth Avenue, New York, N. Y.

Chicago Office: 1742 Monadnock Block, L. C. Bassett, *Manager* | **Cleveland Office:** 501 Caxton Building, Harry Krohn, *Manager*

How Silver Solder Serves Electrical Arts

Solders containing silver have many vital uses in the manufacture of things electrical. Their usefulness is predicated on the following and other well-established characteristics.

1. High electrical conductivity—above that of spelter solders.
2. Flow at lower temperature than brazing solders.
3. Various compositions withstand operating temperatures up to 1600°F—and are therefore admirable for joints that are liable to heat above the melting point of soft solder.
4. Operate on the welding principle, but it is not necessary to heat the parts to so high a temperature as in autogenous welding. This avoids the weakening of parts contiguous to the welds.
5. Make strong joints, with tensile strength ranging from 40,000 to 60,000 lbs. per sq. in.
6. Have marked power of resistance to shock and continued vibration.

A Few Typical Applications

(a) For joining commutator segments.
(b) For soldering leads or other joints subject to rise in temperature above the critical point for soft solder.
(c) For joining bus bars, contactors, etc.
(d) For brazing rotor bars and end connectors on polyphase induction motors.
(e) For sealing electric light, radio or x-ray bulbs.

Briefly Summarized

Silver solders are preferable to either hard or soft base-metal solders in the assembly of parts where strength and permanence of joints is essential; where high temperatures are likely to be encountered; where high electrical conductivity is desirable, or where it is important to avoid the use of the extreme welding or brazing temperatures required by brazing solders or autogenous welding.

"Handy" Solders Are Accurately Standardized

Our 61 years as fabricators of precious metals; our fully equipped laboratories; our trained technical staff have enabled us to conduct thousands of carefully-checked experiments and tests during the past few years to determine the proportions of silver, and other metals which will best meet typical requirements.

In this way we have been able to reduce Handy Silver Solders to 12 guaranteed formulas. These vary in silver content from 80% to 10%.

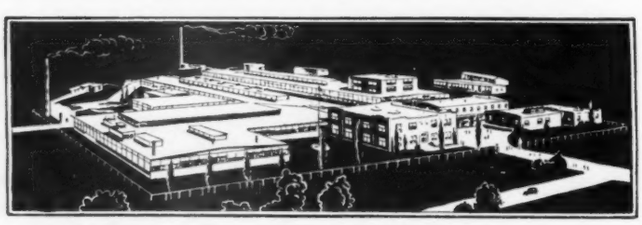
WE CO-OPERATE

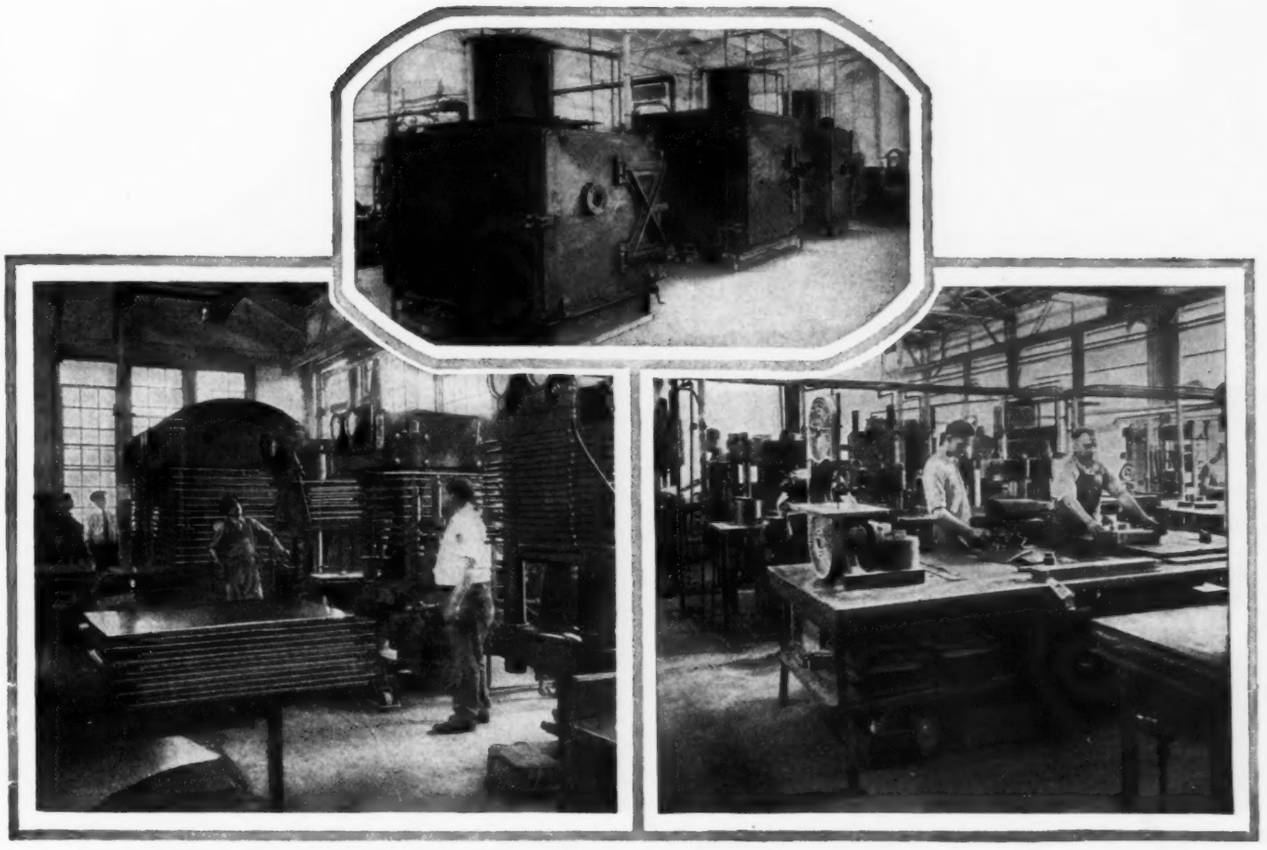
Our Testing Laboratory is at your service for new and unusual problems. Records of thousands of tests, made by ourselves and our customers, enable us to speak with a degree of authority. We will consider it a privilege to co-operate with you in solving any soldering, brazing and welding problems that you submit to us.

Our "Handy Book of Silver Solder E" contains valuable data. Send for your copy.

HANDY & HARMAN

GENERAL OFFICES
57 WILLIAM STREET, NEW YORK CITY
PLANTS: Bridgeport, Conn. Providence, R. I.
Fulton and Gold Sts., New York City





These facilities mean quality and economy

The extensive manufacturing facilities which have produced millions of pounds of Textolite laminated are now available to industry.

Powerful presses, giant ovens, saws, cutters, grinders—every item necessary to mass production is at your service.

G-E research and design facilities, superior workmanship, exacting inspection, and the best of materials raise the quality ever higher; and the experience of years insures high-grade, economical production.

Standard stocks of rod, tube, and plate enable prompt shipment to be made; and special sizes and shapes are available on short notice.

The nearest G-E office is always ready to furnish complete information.

GE Textolite Laminated

885-16

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

AICO
A real
Merry Christmas
to all
AMERICAN INSULATOR CORP
420 LEXINGTON AVENUE, NEW YORK

No. 112 W. B. Adjustable Legged Stool

Economical, fire resisting, and sanitary. Your investment in ANGLE STEEL is a wise one. We build special equipment according to your specifications. Ask for our new 112 page catalog of complete buyers information on up-to-the-minute steel equipment.

If it's ANGLE STEEL it's Long-lasting, Profit-making Equipment!

UNCORK the works—lift the cover off your factory, and see those many places and opportunities to increase production and profits.

Notice that man over there in the corner—look at his position—see how *just one* ANGLE STEEL STOOL would help him in his work?

Now look around further—and you will find scores of places where a single piece of ANGLE STEEL EQUIPMENT would work wonders.

You will find ANGLE STEEL EQUIPMENT a time defying investment. It possesses a large reserve of strength. Produced to withstand the hard usage of the average employee—and meet it year after year. Designed for comfort and efficiency also, it helps to counteract that "3 o'clock fatigue." In other words it helps to increase production and increase profits.

Whether you purchase ANGLE STEEL chairs, benches, tables, stools, desks, cabinets, machine tenders, trucks, bench legs, or any of the dozen other leading items—you are actually making an investment in increased profits.

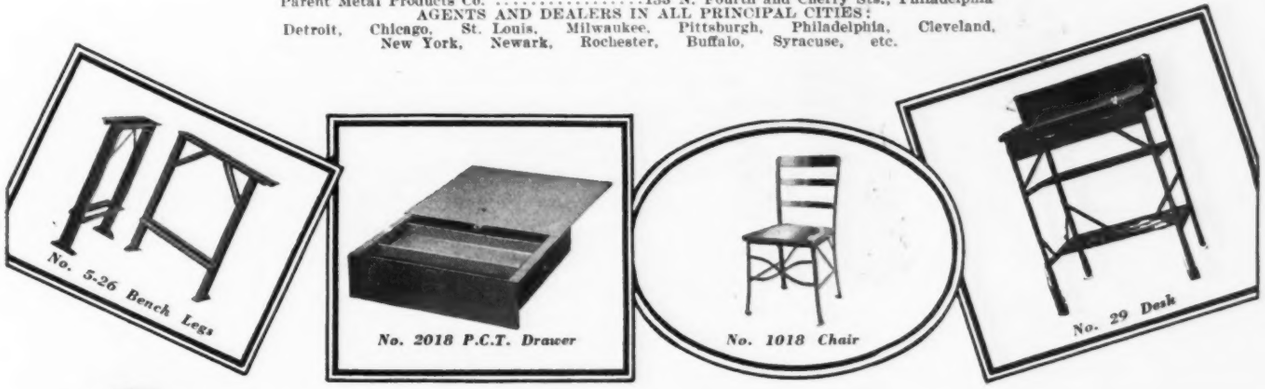
ANGLE STEEL STOOL COMPANY

Main Office and Factory: Plainwell, Michigan, U. S. A.

BRANCHES:

Angle Steel Stool Co. .....98 Park Place, New York
Angle Steel Stool Co. of Illinois .....325 West Madison St., Chicago
(*This branch carries an especially large stock*)
All Steel Products Co. .....38 State St., Detroit
Parent Metal Products Co. .....133 N. Fourth and Cherry Sts., Philadelphia

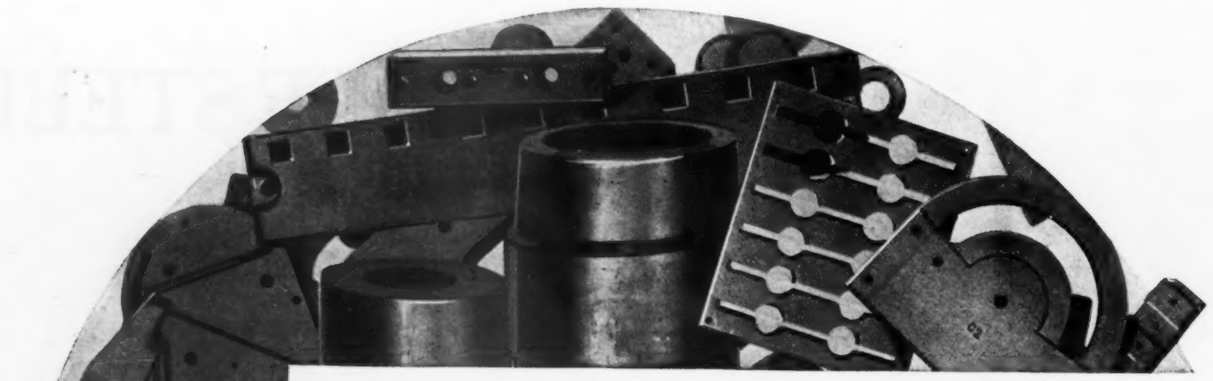
AGENTS AND DEALERS IN ALL PRINCIPAL CITIES:
Detroit, Chicago, St. Louis, Milwaukee, Pittsburgh, Philadelphia, Cleveland, New York, Newark, Rochester, Buffalo, Syracuse, etc.



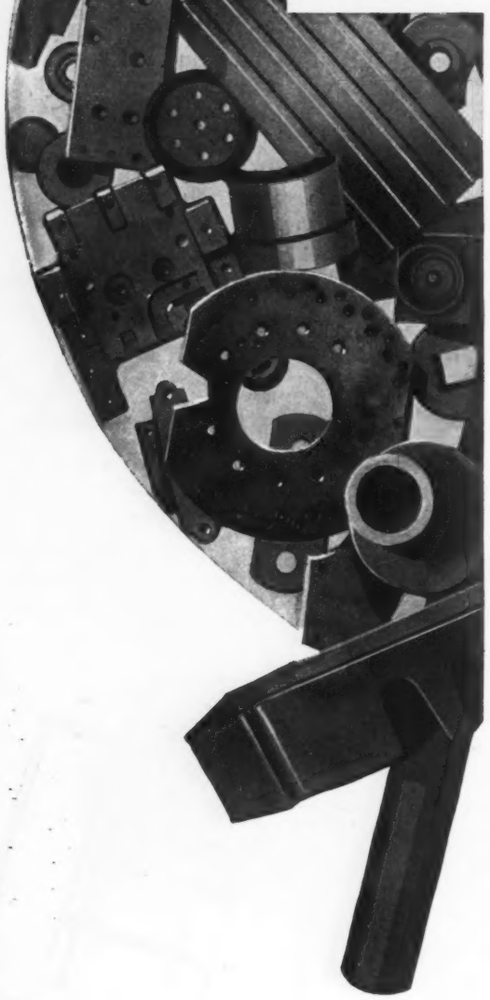
Permanence in Steel

ANGLE STEEL EQUIPMENT U.S. STEEL

ECONOMICAL - SANITARY - DURABLE



For Moulded Forms



Specify
ASBESTOS EBONY

Monolithic . . . Substantial

THE working conditions which are met by moulded insulation are widely varying. Yet in all cases it is safer to use a material which is free from splitting, impervious to water, and has a high dielectric resistance.

Johns-Manville Asbestos Ebony is made from asbestos fibres and a specially compounded Portland cement combined into a rigid monolithic material which can be moulded to meet your requirements.

On battleships and dredges, in power houses and mines all over the world, Johns-Manville Asbestos Ebony is famous for its performance as switchboard panel material. This same performance is to be counted upon when the same material is used in moulded form.

We are always glad to estimate or make suggestions regarding the use and cost of moulded Asbestos Ebony. *Address Electrical Department, Johns-Manville Corporation, at New York, Chicago, Cleveland or San Francisco.*

MASTER *of* ASBESTOS

Johns-Manville

MOULDED ASBESTOS EBONY

GAIR DISPLAY CONTAINERS

GAIR Display Containers are turned out nimbly in many variations of style by our Creative and Design Department. The setting for the merchandise to be exhibited is the important thing. The treatments are endless, but in the multitude there is just one that reaches the crest of your requirements.

The individuality of the Display Container is derived from the merchandise it contains and the whole becomes an impressive ensemble. Our experts see to that.

Gair Display Containers harmonize with your goods structurally as well as artistically. There are no two alike—like gallery pictures, each has a dissimilarity of style that gives it its own character.

ROBERT GAIR COMPANY

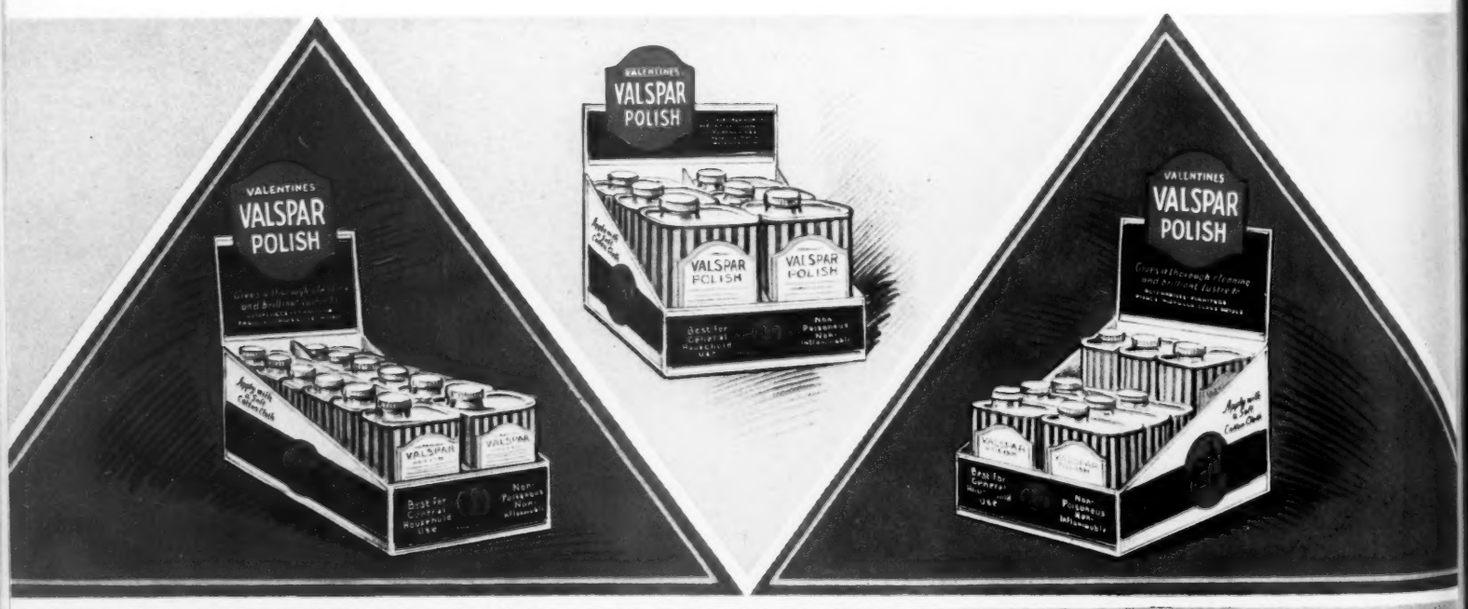
[illegible] AVENUE, NEW YORK CITY

GAIR DISPLAY CONTAINERS

THE retail shop is a wonderland of merchandise. The customer's vision is stimulated by a myriad of articles, but there are always some that focus attention—they are the star exhibits in the merchandising scheme.

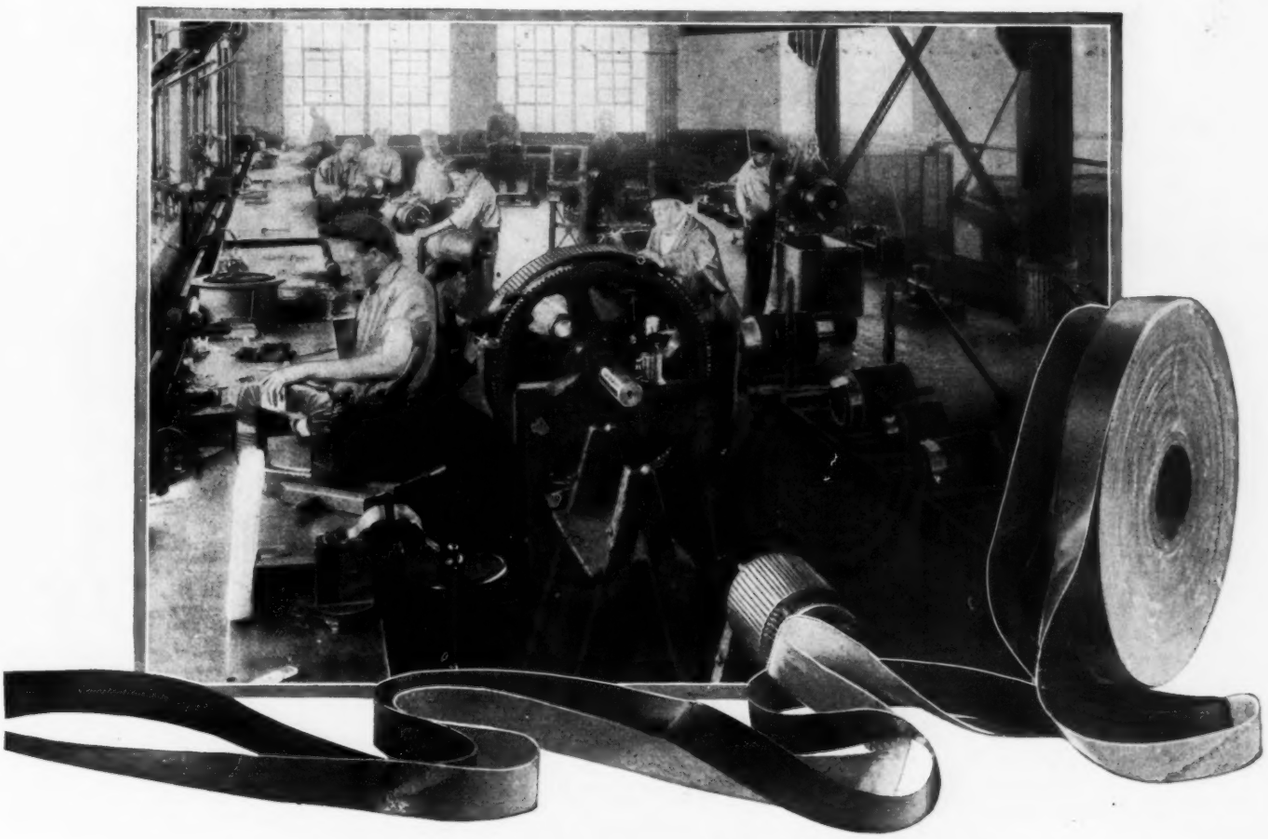
Gair Display Containers have this power of attraction. They are as unlike as it is possible to make them. Our designers clear their tables and their heads of things that have gone before, set your merchandise before them and project their minds into your problem. They reckon with competitive environment and give imperative qualities, as well as stability, to the structure of your display.

Our Merchandising Expert and Artist put their combined experience into your Display Container, one with the earnest purpose of creating a medium for increasing your sales, the other assisting that purpose with the magic of color and design. They work scientifically. They have the instinct and experience with which to give the right accent to your merchandising appeal and broaden the consumer's acquaintance with your goods.



ROBERT GAIR COMPANY

420 LEXINGTON AVENUE, NEW YORK CITY



Age-resisting flexibility
under heavy loads and high temperatures

Wind the coils and bend the end turns to any desired radius — no matter how small—there is no danger of injuring the insulation when "Empire" oiled cambric is used. Run the Empire insulation right up to oil switch terminals on the generator and feeder panels — transformer and switch oils do not affect it.

"Empire" oiled cloths are outstanding in their practical advantages. Time and high temperatures do not impair the original pliable strength and the high initial specific resistance. It is truly "the age-resisting electrical insulation."

Such qualities are not accidental. Modern methods of manufacture, the finest of raw materials and a craftsmanship of 35 years' experience combine to maintain for "Empire" the leadership which it has enjoyed since it pioneered this type of insulation.

Mica Insulator Company, New York: 200 Varick Street. Chicago: 542 So. Dearborn St. Cleveland, Pittsburgh, Cincinnati, San Francisco, Los Angeles, Seattle; Toronto, Montreal. Works: Schenectady, N. Y. London, England.

PERFECT MICANITE INSULATOR REG. U.S. PAT. OFF.

Electrical INSULATION

PERFECT EMPIRE INSULATOR REG. U.S. PAT. OFF.

MICA INSULATION OILED CLOTH INSULATION

International custom molding service produces moldings of endless variety, including all required metal inserts.

Where variety helps

Whether your molding job is the simplest or the most intricate, there is nothing like varied experience to give it the touch of perfection.

TO custom molders, each new job usually brings a new problem. In solving these problems, International has accumulated a fortune of experience.

This fund of experience—drawn from as far back as almost the beginning of molding itself — becomes your working capital without interest when you join us as a customer.

Under charges, we supply you the best of equipment and the geared-up ability to handle work which goes with large volume production at full blast. Charges which new customers continually tell us they find unexpectedly well within reach.

We take entire responsibility for everything. Simply give us your blue prints, specifications and delivery schedule.

Your molds will be made right and on schedule. So too your inserts—screw machine, punch press or what-have-you. Assembling will be done as part of the molding process.

All under our own roofs and our own rigid inspections and production schedules.

You will be well pleased.

PRECISION MOLDERS OF BAKELITE AND SHELLAC COMPOSITION

INTERNATIONAL INSULATING CORPORATION

Division of The General Industries Co.

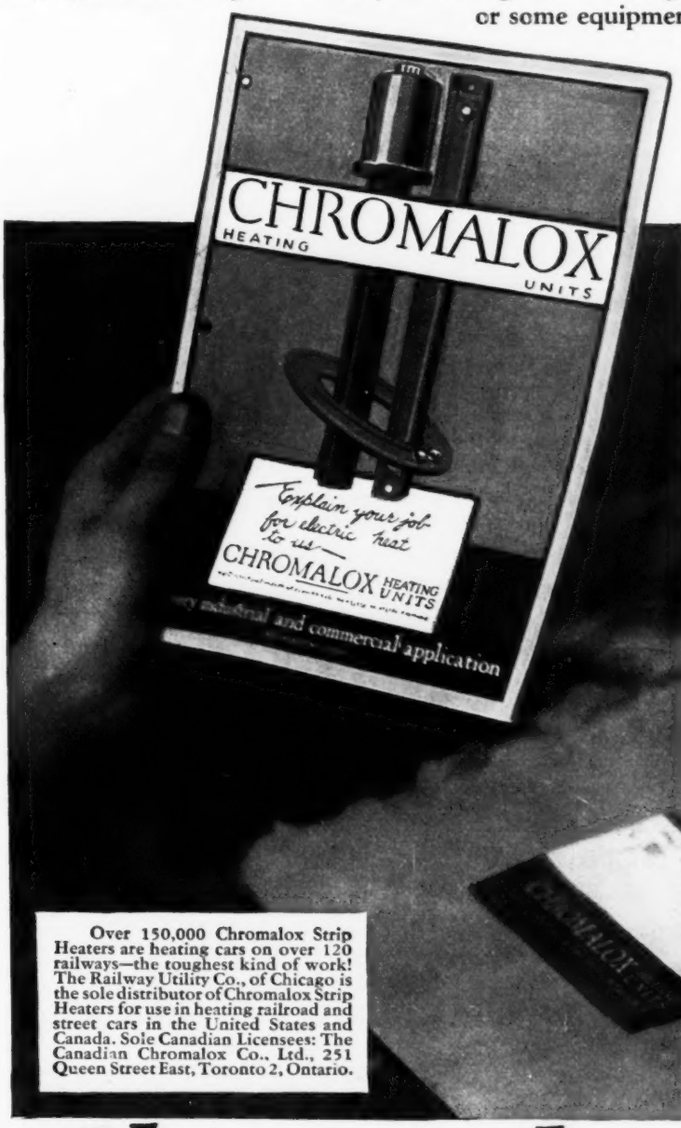
ESTABLISHED 1875 ELYRIA, OHIO

The services of our estimators are at your disposal without obligation. Our wide experience in producing moldings in great variety assures you of practical co-operation. May we hear from you?

★WRITE *for your* COPY~

you'll find it helpful if you are designing *a New Product* or improving *an Old one* . .

Are you in the midst of designing a new product and wondering about the heating unit—what's the right size, type and rating? Or are you ironing out the rough spots in an otherwise good electrical appliance or some equipment, that would be a "best seller" if only the heating unit were what it should be?



★ *Then you'll want a copy*

In it are priced and pictured the many sizes of Chromalox heating units being built into the electrically heated products of over 60 leading manufacturers of appliances . . . ranges . . . hotel and restaurant equipment . . . industrial equipment.

★ *How you profit by having us work with you*

Each of the manufacturers with whom we have worked have saved time and money in costly experiments, both with their products—and with ***their customers.*** Most of them called us in to help with the final design of their product. In all instances, we showed them the ***right*** way of building heating units into their products so that their products would ***stay sold.***

★ *But what about your products*

Tell us about your developments. No doubt we could do some helpful things for you as we have done for dozens of other manufacturers. It's surely worth considering. Mail the coupon now for your copy of this 8-page booklet—telling us about the appliances or equipment you want properly heated. There's no obligation.

Over 150,000 Chromalox Strip Heaters are heating cars on over 120 railways—the toughest kind of work! The Railway Utility Co., of Chicago is the sole distributor of Chromalox Strip Heaters for use in heating railroad and street cars in the United States and Canada. Sole Canadian Licensees: The Canadian Chromalox Co., Ltd., 251 Queen Street East, Toronto 2, Ontario.

Chromalox
ELECTRIC HEATING UNITS

★ *. . . mail with your letterhead!* Elec. Mfg. 12-28

Edwin L. Wiegand Co., 422 First Ave., Pittsburgh, Pa.

YES, without obligation, send me a copy of this Chromalox bulletin and any other data that will help me determine what heating units should be used for heating a _____

_____

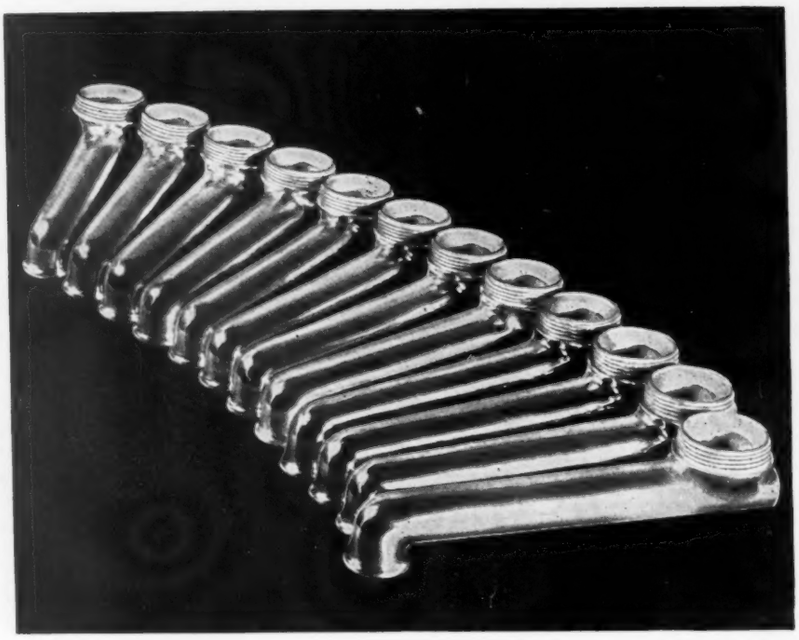
_____

Signed _____ *Position* _____

(PLEASE WRITE PLAINLY)

Duplicates

. . . to the thousandth of an inch



STEWART DIE CASTING service produces many definite advantages in the manufacture of hundreds of different types of product, each advantage contributing to the major feature of over-all economy.

Production economies include:

Reduced unit costs.
Simplified design.
Complete interchangeability and simpler, faster assembly.
Release of manufacturing facilities for other work.
Release of working capital.
Elimination of manufacturing "grief."

Improvements in finished products are:

Better finish.
More striking sales features.
Enhanced performance based upon accuracy and simplicity of design.
Fewer adjustments and less "free service" required.
Improved performance as a result of detail improvements possible with the Stewart Die Casting process.

Stewart engineers are specialists in die design and in the adaptation of products to production as die castings. Their services are available to manufacturers without charge. The Stewart plant is the largest in the world devoted exclusively to die casting. Automatic machinery, principally of Stewart design, and an organization highly trained in the Stewart process, insure economy, accuracy and unrivalled standards of service.

ACCURACY—in the Stewart Process of Die Casting—means faultless die castings throughout widely varying quantity requirements.

Fast, simplified assembly, complete interchangeability, the definite elimination of spoilage are results that cut costs all along the line. Manufacturers using Stewart service find that in addition to these very definite advantages in production there are many others which contribute to performance or salability of the completed product.

Definite details of the advantages of Stewart Die Casting as applied to your product will be furnished on receipt of blueprints or a sample of your present production.

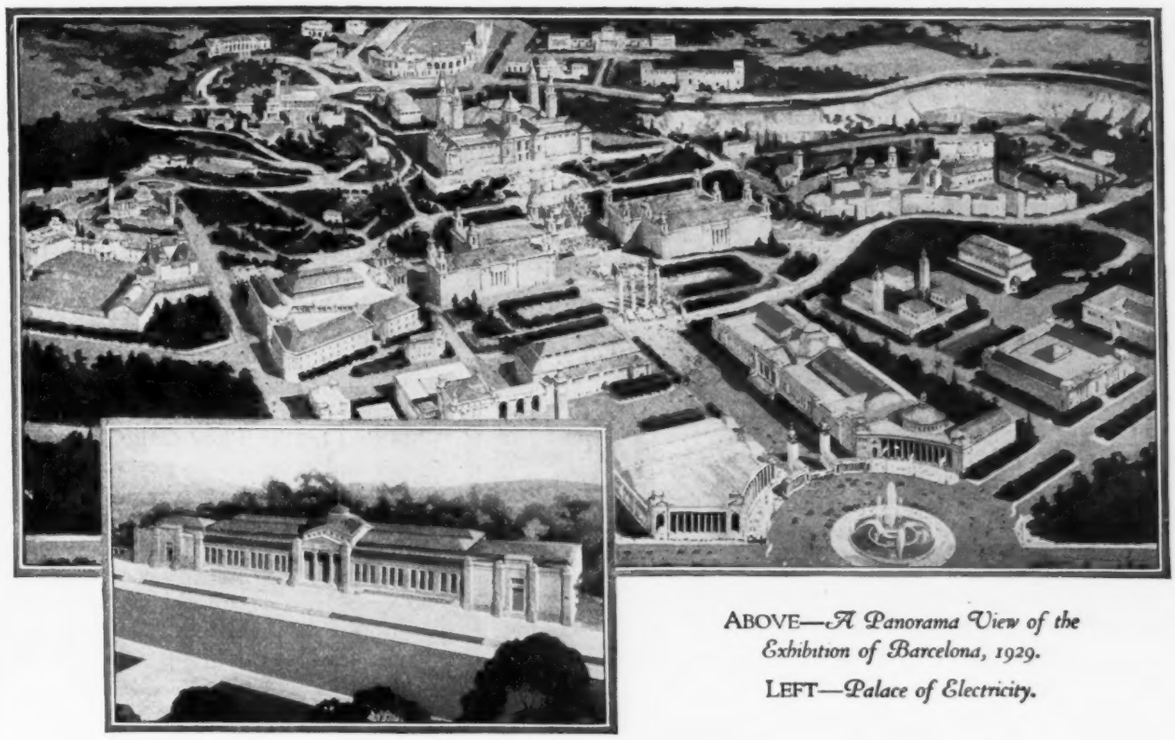
The Stewart Die Casting Corporation

4500 Fullerton Avenue, Chicago, Ill.

Detroit Pittsburgh Milwaukee St. Louis Dayton
New York City Cleveland

E M 12-Gray

Stewart



ABOVE—*A Panorama View of the Exhibition of Barcelona, 1929.*

LEFT—*Palace of Electricity.*

An Export Opportunity for Electrical Equipment

The Exhibition of Barcelona, 1929, is the American manufacturer's gateway to win, not only the rich fertile Spanish market (Spain is third wealthiest of world powers), but also to attract and interest the buyers of the 23 other countries of the world, who are being urged to attend through a world-wide advertising campaign.

At the Palace of Electricity leading manufacturers from all parts of the world will display their electrical equipment products. On the heights of famous Montjuich, 12,734,810 square feet of space is being occupied by the Exhibition. $21,372,000 is appropriated by the Government of Spain and the city of Barcelona —to apprise other nations of the tremendous industrial activity and economic progress already on foot in *new* modern Spain—and to impress the whole world of Spain's importance as an export gateway for world-wide acceptance of industrial products.

All of the world that matters—industrially . . . commercially . . . scientifically . . . artistically . . . will see and appreciate the exhibit of American manufacturers—*your line*—of electrical equipment at the International Exhibition of Barcelona, Spain, 1929.

Special low freight rates . . . arrangements for no tariff on materials for exhibit . . . exhibition space without charge for American manufacturers seeking the Spanish market.

For full information and vital statistics on the existing market for your product in Spain and Europe, address United States Delegate, Exhibition of Barcelona, Dept. 312 Steinway Hall, New York City.

International Exhibition Barcelona

May—1929—December

Where the race of competition is keen, Durez *helps to get there first*

IN THE close competition of the radio field Durez offers truly remarkable production economies which no manufacturer can afford to overlook.

The Mack Molding Company, Little Falls, New Jersey, can bear witness to that truth. They make charger covers and other radio parts with Durez.

Durez parts come from the mold in finished form. One single operation—that's all. No tooling. No buffing or polishing. No costly finishing work. Durez molds quickly and faithfully into the most intricate design. It comes out hard as flint and with the lustre of burnished ebony. And—a tool has not touched it!

The quick fusing and hardening properties of Durez assure rapid and economic production. It has high mechanical and dielectric strength. It is ideally suited to the manufacture not only of radio parts, but of products in countless other lines. Indeed, many manufacturers tell us that Durez is the most satisfactory molding compound they have ever used.

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General Plastics, Incorporated, 116 Walck Road, North Tonawanda, N. Y. Also New York City, Chicago, San Francisco.

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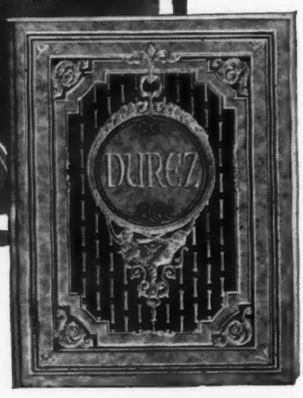

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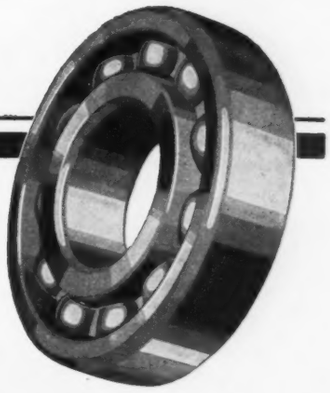

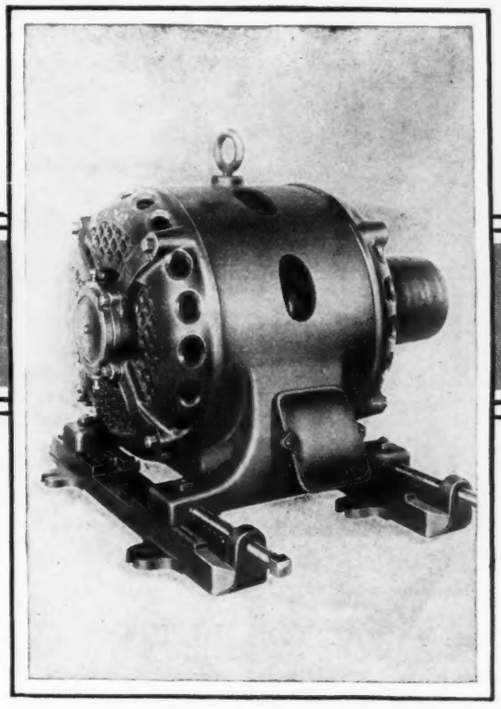

957

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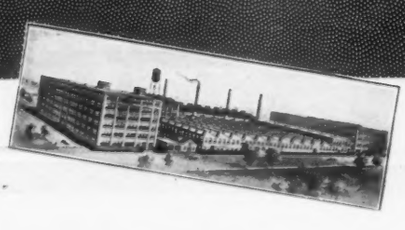
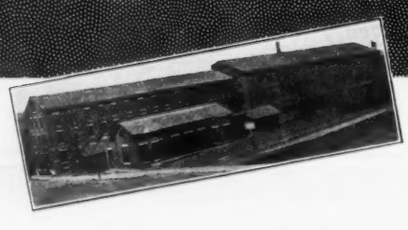


Main offices and Plant, Scranton, Pa.



Auburn Plant, Auburn, New York

Electrical Manufacturing

Production - Marketing - Administration - Repairing

Volume 2 DECEMBER - 1928 Number 6

PROGRESSIVE OBSOLESCENCE

By E. W. McCULLOUGH

Manager, Department of Manufacture, Chamber of Commerce of the United States

PRODUCTION in many lines of industry has reached its peak, at least until larger markets and better distributing methods are established. Consequently, to build more plants and to create more capacity for production in those lines is little short of folly. There are exceptions, of course. One of them is where a market is found for the commodity and the factory is so located as to be able to take advantage of it, provided other manufacturing requirements are also fulfilled. Another exception is found in the new factory built to utilize the latest processes and equipment and, therefore, able to compete more than successfully with older units of the industry that are retarded by an obsolescence problem.

What is progressive obsolescence? The best answer consists in simply pointing to two outstanding examples, the automobile industry and the radio industry. It has been the guiding principle in these two industries since shortly after their inception, and we are so used to it there that we scarcely think of it in other fields except possibly in connection with style commodities, such as clothing. Nine or ten years ago the crystal radio set was the rule. These were scrapped for one-tube sets, and these in turn for two-, three-, four-, five-, up to nine-tube sets as fast as science made them available.

The parallel holds true as well in the production of goods. The industrial world supremacy of America is based on the application of the principle of progressive obsolescence in both factory and office. Andrew Carnegie secured for this country supremacy in steel by building and tearing down one steel mill after another as metallurgical science indicated the way. His scrapping policy revolutionized the industrial world.

In developing any program of industrial expansion we are then confronted by the operation of the principle of progressive obsolescence in two different directions, either one or both of which can become the source of much industrial grief if not carefully evaluated before definite commitments are made. If a community is about to obtain a new industry, it is well first to ascertain the degree to which its principal product is either coming into use, or going out of use, together with all important modifications that will eventually have to be faced. We are often prone to think of competition only in terms of that which we encounter from other manufacturers in the same line of industry. Instead, whole industries today are competing with each other for the supplying of the same demand through different media.

Again, if a community is about to obtain a new industry, it must in addition assure itself that the proposed process and equipment are sufficiently modern in type to permit the new plant to compete successfully with the latest developments in its particular field. On every side we hear much today of the excess manufacturing capacity that exists in many lines. Not so frequently, however, do we hear the corollary to that old story, viz., that anywhere from 25% to 75% of that excess capacity in any one particular line might be in such a stage of obsolescence as to make its early extinction an act of economic justice. But in these days of miscroscopic or invisible margins of profit, manufacturers are prone to ask how they can afford to carry out extensive scrapping policies. The answer is found in subscription to the newer idea that obsolescence of plant is a legitimate element in the cost of production—a sort of advance charge that must be deducted from profits in order to insure the creation of a fund sufficiently soon to buy new equipment when it has been demonstrated that existing equipment is no longer in position to compete.

Helping INDUSTRY a
to *GREATER*

The National Association of Manufacturers deals with the problems common to all manufacturers. It is the largest national body representing manufacturers of all classes and is recognized as voicing the opinion of manufacturers on matters of industrial and commercial importance

By JOHN E. EDGERTON
President, National Association of Manufacturers

TODAY our association is engaged in a specific effort to take the tariff out of the field of political consideration in the belief that tariff administration should be in the hands of a non-partisan organization.
JOHN E. EDGERTON

THE National Association of Manufacturers is a mutual organization of manufacturers for the promotion of the industrial interests and commerce of the United States, the betterment of relations between employers and employes and the submission of its best counsel and cooperation to all related government agencies for the development of the business and financial interests of the nation at home and abroad.

It is the largest national body representing manufacturers of all classes, from the organization with a few employes to great ones employing as many as 200,000. It is the recognized national organization voicing the opinion of the manufacturers on matters of common industrial and commercial importance.

Its field is problems common to all manufacturers. It plays no partisan politics. It asks no special recognition for special groups. It enlists in no sectional campaign. It believes in no favored nation save the United States, first, last and always.

And right today the association is engaged in a specific effort with the purpose of bettering the condition of the industry of the country. It is engaged in an effort looking toward "taking the tariff out of politics"—that is out of the field of political consideration, or more specifically taking the politics out of tariff. It recently assembled in New York City a group of more than one hundred leading industrialists of the country, representing various industries, to devise ways and means toward this end. It is the belief of the manufacturers that tariff administration should be in the hands of a non-partisan commission, not bi-partisan; something on the order of the Interstate Commerce Commission or the Federal Trade Commission; that the tariff should be scientific and satisfactory to the great majority of business and capable of adjusting itself to ever-changing economic conditions. This effort is in furtherance of the tariff declarations of the Platform of American Industry which was drawn up by another large group of men under the auspices of the National Association of Manufacturers and submitted to both the Republican and Democratic platform builders. The tariff plank read:

"In the light of accumulated experience we more than ever indorse the American tariff principle as necessary to the well-being of agriculture, labor and manufacture.

"We know that a general congressional revision of the tariff, because of its accompanying agitation, develops long periods of uncertainty profoundly affecting employment, investment, the establishment of new enterprise, and the successful conduct of every form of business. But a continuing revision of our tariff schedules including the free list to meet changing economic conditions, in the light of accurately ascertained facts, is essential to the proper conduct of international and domestic relations.

"An independent, non-partisan, semi-judicial tariff commission presents the only practical alternative to frequent congressional revision, with all its disturbing circumstances."

These one hundred men, after discussing various phases

and the NATION PROGRESS

of the tariff problem, adopted a resolution empowering the chairman to appoint a committee to investigate the question of "how a tariff commission may become an effective functioning body, and with this object in view to consult the Ways and Means Committee, the Senate Finance Committee, the President, the President-elect or such other effective bodies or organizations as in their judgment may be helpful, and report back to this body at a meeting to be called by the chairman."

The Platform of American Industry was first inaugurated in 1920, during the widespread cry for "more business in government and less government in business." The National Association of Manufacturers brought together a committee of fifty-eight without any prearranged ideas or suggestions as to what should be incorporated in the platform or how the planks should be written. The resultant platform was submitted to both Republican and Democratic conventions that year, and much of the substance was incorporated in both national party platforms. The effort was repeated in 1924, and at the same time the association organized and carried on a national get-out-the-vote campaign to induce all eligible voters to go to the polls and vote. The association made its own appropriation for the work, received not a cent from any outside source and gave the literature free to those who cooperated. Something like 25,000,000 pieces of literature were sent out by this organization, and some of those who distributed the red-white-and-blue stickers and the folders showing the decadence of the vote, were the American Legion, the Boy Scouts of America, numerous branches of the National League of Women Voters, Rotary clubs and Kiwanis organizations. The slogan "Vote as you please, but vote," and the colored stickers were devised by the association. This national effort had the result that the President was elected by a majority of a majority of the eligible voters instead of a majority of a minority of the eligible voters. Both these efforts were continued by the Association in the past national campaign but on a much larger scale.

The Formation of the Association

BY birthright alone, the National Association of Manufacturers has a far more intimate relationship with the growing industrial South than is commonly recognized. By the same birthright the association rightly can claim full-fledged American origin, for it was in the same Southland, with the highest percentage of truly American stock in the nation, that the idea for its need had its birth.

Many of us who are not yet in the sere and yellow will recall the dark years of 1893 and 1894, when the entire country was strangling in the tentacles of a financial and industrial depression the like of which had never been known in our history. A tariff-for-revenue-only bill had been enacted into law. It immediately brought on national dislocation and disaster. It quenched the fires of industry, stilled the hum of machinery everywhere in the land, put a sharp stop to production, prostrated trade and industry, threw hundreds of thousands of workers out of employment. It struck into the very heart of the home, with families in straitened circumstances. Men with everything at stake contemplated the wreckage of their hopes and life work with a despair as profound as that of the thousands of toilers thrown into idleness by the paralysis.

The whole nation faced a crisis. And that crisis generated the inspiration and the impulse that resulted in welding the country's manufacturers into a cohesive, effective organization, striving to aid the nation.

Curiously enough, that inspiration and impulse proceeded from a source outside the ranks of industry itself. It grew from a public-spirited desire to offer constructive suggestions for the correction of the situation that threatened the entire nation's commerce and the well-being of its people. It grew, not from the selfish ambitions of a manufacturer to aid only his fellows, not from the desire of an individual to improve his status. There was not the slightest tinge of self-interest or of partisanship in it, but only the frank and generous purpose to be of aid in staying the destruction.

That inspiration was unfolded in an editorial in a southern publication (The Dixie Manufacturer of Atlanta; Thomas H. Martin, editor). The editor, who was of the same political faith as the author of the law, voiced his opinion that the situation, dire as it was, was not

National Association of Manufacturers Upholds These Policies

1.—To the largest possible extent, our home markets should be retained and supplied by our own products and our foreign trade relations should be extended in every direction and manner not inconsistent therewith.

2.—The principle of reciprocity should be embodied in national legislation, in accordance with the requirements of equity, so that reciprocal trade relations between the United States and foreign countries may be developed and extended as far as practicable.

3.—Believing that ships sailing under the flag of the United States should carry our entire maritime commerce, and, in view of the injury thereto by subsidized foreign shipping, we declare in favor of a judicious system of subsidies in order to complete the restoration of our merchant marine.

4.—The Nicaraguan Canal being essential to the commerce of the United States and of National importance, we favor its construction and operation under the control of the Federal Government.

5.—Our natural and artificial waterways should be improved and extended by the Federal Government to the full means of commerce, connecting the Great Lakes with the rivers of the Mississippi valley and the Atlantic seaboard.

irremediable. He suggested that as the country was filled with men who had organized great and prosperous establishments, they should be brought together in a common endeavor to organize a way out for the whole country. He believed that they knew, or should know, better than any other group, the ramifications of the troubles and what was the solution.

Thomas P. Egan, president of the J. A. Fay & Egan Co. of Cincinnati, read that editorial. With far-reaching vision and renewed faith in his country and his industrial associates, he personally took up the suggestion. He sent hundreds of letters to industrial and business men, inviting them to meet and consider the grave national problems. Accordingly, 383 of the constructive minds of industry from every section of the nation responded, impelled by the emergency of national disaster. They met in Cincinnati, Jan. 22, 23 and 24, 1895.

Mr. Egan presided. Without rhetoric or passion he painted a true picture of the depression that was gripping the nation and the misery of its workers. The country was beset not only from within but from without, for the other great commercial nations of the globe were taking the bulk of our trade. Great Britain had opened the Suez Canal and brought the fabled markets of India and far Cathay 10,000 miles closer to her shores than they were to ours. Her commercial fleet had run the famous American clipper off the seas. International commerce was becoming dead history with us. And, as if to rivet his declarations, Mr. Egan quoted an address made by the chairman of the London Board of Trade, who referred to the American tariff bill in these words:

Five General Principles Adopted

"WE thank the great American, the Hon. Mr. Wilson, for our prosperity. He has lighted our fires and made our artisans busy at increased remuneration and wages, and has done more for England than the greatest Englishman of our century."

Mr. Egan declared that for every fire lighted in London and vicinity, two were banked and put out in America, "and more want, starvation and woe visited our American homes than ever took place in the same time before; and more paupers and tramps were created than served in our great Civil War in both Northern and Southern armies."

He was talking to manufacturers and business men who knew what he said was fact; who had suffered, whose men had suffered, and were suffering great losses trying to hold together for better times coming.

The guest of honor was William McKinley, then Governor of Ohio and later President. Governor McKinley gave a vivid analysis of the whole situation, pointing to the fact that this was a nation built great through its industry and its industries, and that upon the substantial life of these depended the life of the nation's manufacturing, commercial and agricultural industries. He declared: "We want our own markets for our own manufacturers and agricultural products; we want a foreign market for our surplus products which will not surrender our markets and will not degrade our labor to hold our markets. We want a reciprocity which will give us foreign markets for our surplus products, and in turn that will open our markets to foreigners for those products which they produce and which we do not. May you be able to devise some plan to improve our industrial situation and start this great country once more upon its march of triumph and for the welfare of our own people and for the good of mankind everywhere."

Putting aside all circumlocution, a permanent organization was formed and called the National Association of Manufacturers. A general statement of principles was adopted as follows:

1—To the largest possible extent, our home markets should be retained and supplied by our own products and our foreign trade relations should be extended in every direction and manner not inconsistent therewith.

2—The principle of reciprocity should be embodied in national legislation, in accordance with the requirements of equity, so that reciprocal trade relations between the United States and foreign countries may be developed and extended as far as practicable.

3—Believing that ships sailing under the flag of the United States should carry our entire maritime commerce, and, in view of the injury thereto by subsidized foreign shipping, we declare in favor of a judicious system of subsidies in order to complete the restoration of our merchant marine.

4—The Nicaraguan Canal being essential to the commerce of the United States and of national importance, we favor its construction and operation under the control of the Federal Government.

5—Our natural and artificial waterways should be improved and extended by the Federal Government to the full needs of commerce, connecting the Great Lakes with the rivers of the Mississippi Valley and the Atlantic Seaboard.

That was thirty-three years ago. The platform, although brief, was so national in interest and so vast in its scope that the whole body of the public might stand upon it, regardless of politics; whether employer or employe, rich or poor, industrialist, financier or professional in occupation. There was not a hint or a threat in it of an organized front against organized labor. It called for more work, for greater employment, for extension of our factories' business overseas and at home, for canal construction, which meant more employment while it was being built and increasingly more after finished because of the expansion of our commerce. It declared for an ample merchant marine, easily translated into the placing of more men in sea occupations and competition with the world. It declared for improvements in inland waterways, another effort to increase employment.

Accomplishments of the Association

IT was not until eight years later the association was forced into a position where it consistently opposed the unjust exactions and discriminations that organized labor sought to impose upon employers, and as well upon their own fellow-workers, entirely regardless of whether they voluntarily chose to submit to those exactions and restrictions. In 1903 the attitude of the association crystallized in the adoption of labor principles, which marked the first declaration by a representative national body for the open shop as a cardinal policy of American manufacturing. In its stand against the exactions of labor the association has been consistent, persevering and effective, but never unfriendly to the worker or to his right to work when, where, for whom and under what conditions he may elect to work.

Long before the association had been forced to this definite stand on labor it had been engaged year after year in working for the realization of the constructive ideas proposed in the declaration of principles adopted at the first meeting. Its efforts have been amazingly successful, and a brief retrospect of its activities and their results will show a list of accomplishments that would do credit to an organization with more years back of it than the National Association of Manufacturers may claim.

The year after the meeting at Cincinnati a great Reciprocity Convention was called in the National Capital, as a result of which many restrictions that had fettered our foreign trade were removed. The Association, however, reached beyond the matter of reciprocal trade relations,

(*Continued on page* 313)

INDUSTRIAL *Engineers* *CAN SOLVE* *Management* PROBLEMS

*Industrial engineering has become one of the major factors in manufacturing and marketing today and the importance of the engineer in industry is explained herewith**

By RAY M. HUDSON

Assistant Director, National Bureau of Standards, United States Department of Commerce

THE past few years have been full of problems for our industrial leaders. New conditions have arisen affecting our earlier conceptions of the relations that produce or maintain business equilibrium and stability. In many instances profits have approached or passed the vanishing point. Therefore, one of the immediate problems of the individual industrial engineer is to determine the effects of the new competition on the business with which he is connected. Another of his newer problems is the correct evaluation of the measures or means employed in meeting that competition.

Hand-to-mouth buying, and the small order problem have brought a host of problems in their train. The conditions giving rise to these developments, the probability of their duration, as well as the ways and means to cope with them are also of interest to the industrial engineer. For example, how can he show a profit if short runs on small quantities, frequent changes of machine set-ups and other similar operations absorb the economies he makes through time study?

Along the selling side of his business, are these questions: What market shifts are occurring in his field? Is the future of the business in the domestic or the foreign market? What is a market anyway? Is our common conception of a market, as a vast reservoir to be filled, correct? A market originates in human wants. Therefore markets are people, not places! People move about; and they take their habits with them. Sometimes they stay in the same place but change their habits. May we not therefore regard "human wants" as the prime source of business, and that the market they reflect is not a reservoir but a spring that flows steadily year in and year out? Nature provides the spring—man's job is to guard it against diversion, stoppage, and contamination, especially if he expects to drink "long and hearty" therefrom.

For the industrial engineer to leave the care and pro-

MANAGEMENT'S opportunity for cost reduction through research along the distribution side of business is tremendous. Studies of present channels or avenues of distribution, the methods employed in each, the actual routes over which goods move, the ways in which the goods are packed and shipped, the types of containers used, the machinery and equipment for handling goods in transit—everyone of these subjects can be studied with profit.

RAY M. HUDSON

* Abstracted from an address made by Mr. Hudson before the National Convention of the Society of Industrial Engineers at Rochester, N. Y.

tection of the well-springs of his own activities to others, no matter how able they are, and merely to accept what comes out of his end of the supply pipe is to take too much for granted. A good engineer takes nothing for granted. He goes clear down to bed rock as the foundation on which he builds.

Assurance of a permanent market, and preparedness for changes in that market safeguard the work of the industrial engineer, yet how many of us have checked the foundations on which we are building daily?

¶ The alert industrial engineer will not overlook the development of new industries likely to affect either his present sources of raw materials or the markets for his products and their cost of manufacture.

ANOTHER development of recent years is in the migration of industry. Studies show definite movements in many lines of industry. In some lines, plants are being moved closer to the source of raw materials; others closer to their markets, i.e., the consumers of their products; still others are moving to more favorable power sources, climatic conditions; and so on. What underlies these movements? Are they undertaken solely because of present costs? Do these shifts, as and when made, assure lower costs and better profits? The answers to these questions concern the industrial engineer. Isn't it as much his responsibility to discuss this problem with his executives even as he discusses with a shop foreman the shifting of a shop tool to a new location? Why give so much thought and study to shifting machines within a plant, when it may be of far greater consequence to shift that great tool of production, the plant itself?

Coming back to the problem of inter-industry competition, the alert industrial engineer will not overlook the development of new industries likely to affect either his present sources of raw materials or the markets for his products. In the one case, he may be able to get his present raw materials cheaper, or get new and more satisfactory raw materials at no greater cost. If the new industries turn out a product likely to disrupt the market for the engineer's product, or displace his product in that market, the engineer must be prepared to advise how best to meet that situation. To illustrate, wastes from agricultural products are being intensively analyzed for their valuable constituents, by a number of agencies. Many of the derivatives discovered to date bear close enough relation to products in wide demand such as building materials, paper, alcohol, and the like to warrant careful watching by those concerned with the latter products.

¶ The costs of changes forced onto a business by the new competition, hand-to-mouth buying, market shifts, and the migration of industry, research and invention may have absorbed to a greater extent than we realize.

THE recovery of millions from waste materials is a comparatively recent development in American industry, especially in fields other than mining. The progress in that field is well-known. It is also well-known that in some cases the by-products recovered are worth more than the principal product. In view of this, the industrial engineer may find, in those cases where competition and other conditions are so severe that a profit can not be made on the product, that his real profits are in the recovery and sale of his by-products. In any event, he cannot afford to devote his whole attention to the product, and give no thought to the wastes.

The costs of the changes forced onto a business by the new competition, hand-to-mouth buying, market shifts, and the migration of industry, research and invention may have absorbed, to a greater extent than we realize, the economies and savings wrought in production.

The question is, "Could these changes have been foreseen, and if so, could they have been handled so as to avoid this absorption of profits?"

The answer is "Yes," for it is assured that the industrial engineer is fully capable of sensing the approach of new conditions and problems in industry, and of preparing to meet them efficiently and economically.

But, to attain this degree of preparedness, the industrial engineer must first expand his horizon beyond the shop walls, and perfect his observation of the broader currents of business. He can do this through review, interpretation and use of the statistics of business. To ignore these indicators of trends is to be caught napping. Of what use is a barometer if you do not heed its storm warnings? Why spend months or years in perfecting some part of shop management technique if the whole program is "washed out" by failure to observe important market changes or shifts in the buying habits of your customers? Why try to perpetuate a plant when each day that passes marks the fading of the industry to which that plant belongs?

There is something heroic in the devotion of the captain and the crew to a sinking ship, but we may well question the value of efforts to save a sinking industry, especially in those cases where it evidently has outlived its usefulness. Why should not every industry, also every plant within it, maintain a "look out in the foretop," to scan the business horizon? The master mariner steers toward his objective. Too often in business, we drift, only to discover too late we are amid the shoals—if not actually on the rocks. Who, other than the industrial engineer, is qualified to do our piloting?

¶ Finding the facts on which to base decisions, or to take executive action is not always an easy task. The job takes time, energy, patience and persistence. It costs money too, but it develops sense of values.

A FREQUENTLY neglected source of lower costs and better profits is research—commercial, technical, and scientific. Research is defined as "careful or critical inquiry or examination in seeking facts," and facts, as you well know, are the foundation of modern management. Finding the facts on which to base decision, or take executive action is not always an easy task. The job takes times, energy, patience and persistence. It costs money, too, but there's nothing like research to develop one's sense of relative values. How often we find that the whole complexion of our problem changes with the discovery of certain new facts. Likewise, how often certain wastes of time and money, of material and labor, could have been avoided, if we had in hand at the time of our action, certain facts which came to light afterward?

"Any company which does not adopt a policy of research in its business may as well set the date of its liquidation. I believe that in research is the answer to a competition that is increasing every day." So speaks Charles Belknap, vice-president of the Merrimac Chemical Company. "Eternal research is the price of survival in modern industry. No investor or banker can feel sure that his interest in any security is secure in the absence of the assurance given by the knowledge that science is on guard." This is the statement of Hugh Farrell, a well-known writer on business and economic subjects, and author of "What Price Progress."

Certainly research is as important to the stability and

success of business as is advertising and other forms of sales promotion, and American industry spends over a billion dollars a year for advertising alone. If industry were to spend but one-fourth of that annual sum in research devoted to improvement of products, processes, and the machinery or equipment used in connection therewith, many of our present worries as to new markets, larger sales, and better profits would fade away.

There is scarcely a phase of business which can not be strengthened by research. Analysis of markets, and back of them, the study of human wants, gives new conceptions of what to make and where to sell it. Studies of the rate of consumption, the potential buying power of the public, indicate whether or not the public can absorb more of your output. Analysis of present uses of your product, and study of fields of its possible application serve either to increase sales or to establish the point of diminishing returns.

When to change the style, or re-design the product is not a matter of chance. "Coming events cast shadows before." Profitable management requires anticipation of, and insurance against, sudden shifts in the public taste or fancy.

Managements' opportunity for cost reduction through research along the distribution side of business is tremendous. Studies of present channels of avenues of distribution, the methods employed in each, the actual routes over which goods move, the ways in which goods are packed and shipped, the types of containers used, the machinery and equipment for handling goods in transit—every one of these subjects can be studied with profit. To assume we have reached the peak of refinement of simplification in any one of these features of our distribution service is absurd. The greatest opportunities for cost reduction are in distribution. There is no question about that, for practically nothing has been done in this direction, when compared to the great concentration of effort toward reducing production costs. We could well afford to let present production costs alone for the next five years and focus all our energies on whipping this distribution problem.

¶ Certainly industrial research is as important to the stability and success of business as is advertising and many other forms of sales promotion, and industry spends over a billion yearly for advertising alone.

SAVINGS made in that end of the business are just as valuable a contribution to a satisfactory annual net profit as those made in production; and they ought to be easier to make. As an example, it has been common practice to pack goods at the factory, break down the container at the wholesalers, reassemble and repack them for forwarding to the retailer. The latter puts them onto his shelves, takes them off the shelves, wraps them and delivers them to the consumer. Suppose a manufacturer were to package his goods in proper consumer units at the factory, pack them in a standard reclaimable container holding a quantity consistent with the retailer's normal requirements and consistent with the wholesaler's cost to handle an order of that size, and then encourage the wholesaler to order from the manufacturer in mutiples of that scientifically determined unit order, would not this simplify the problem and save present wastes?

Another prospect for large savings is in the better coordination of the physical movement of goods from initial producer to the ultimate consumer to provide a more nearly stream-like flow. The convenience and ease of the lift truck and skid platform system of movement, hitherto used chiefly within the plant, but now being extended to inter-plant shipments, suggests its wider application to movement from manufacturer to retailer. Other examples might be cited, but suffice it to say research in distribution will open the way to lower costs and better profits.

The possibilities for further savings that assure profits through continuing application of research to production have not been fully determined. There are still many opportunities for the development of new products, new materials, new processes, and new machinery or equipment. In his search for ways to lower cost, the industrial engineer should pay more attention to both research and invention. Many of our industries seem to suffer from over-fondness for "things as they are." At least there is a reluctance to "change," not entirely accounted for by opposition to the costs of making it. More of us need to look away from the "good old days and their good old ways," and to take a longer look ahead. If we would be progressive, we must watch new developments in both science and business, and be ready to adapt or apply them to our daily operations.

¶ To assume that we have reached the peak of refinement of simplification in any of the features of distribution service is absurd, for the greatest opportunities for cost reduction will be found in distribution.

SIMILAR opportunity to cut costs and strengthen profits is found in the new developments in the auxiliaries of production, such as power, light, heating and ventilating, sanitation, etc. The installation of more modern equipment to perform these services will in many cases not only reduce their present costs, but also improve the service by lessening the interruptions to production caused by the inefficiencies of present equipment.

The precise control of quality of product offers an opportunity to reduce the wastes, and consequently the costs, in those cases where too much responsibility is placed on individual judgment. While "go" and "no go" gages are widely used to insure dimensional accuracy, there is not a corresponding use of other control devices or methods in securing the requisite degree of accuracy in quality. If we would maintain high standards of quality in our products, we must perfect and standardize the means and the methods of measuring product in terms of those standards. In this connection, the research work of our Bureau of Standards offer much to the industrial engineer, in his search for that scientific knowledge so essential to the future of our industries.

We are in a new era of business, one in which scientific investigation, application and control are playing a most important part. Rule-of-thumb, and empirical methods must give way to the new order. Profits are no longer the difference between selling price and cost. Instead they are the difference between new ideas and old ones, new methods and out-of-date ones, new equipment and obsolete.

¶ The possibilities for further savings that assure profits through continuing application of research have not been fully determined. There are still many opportunities for the development of new products and markets.

THE complexity of modern business and the increasing interdependence of its components, and of those engaged in their operation, demands a more definite integration of interests, a closer coordination of efforts, and greater cooperation among all individuals concerned with a common undertaking. In modern business, no man lives unto himself alone, and least of all the industrial engineer. The successful conduct of American business rests more with him than

(*Continued on page* 312)

What's *the* APPLIANCE

SINCE the woman in the home is so largely the one who decides what shall be bought for the home, it is rather important, is it not, to see a possible new market through a woman's eyes? American manufacturers are asking many questions these days about the European market. To answer some of them, ELECTRICAL MANUFACTURING presents this interesting study of the English market for electrical appliances as seen by an American woman connected for years with the electrical industry. THE EDITOR

"WHAT we need is a good wash-up machine.....you know, an electrical dishwasher. The women who come to our exhibits are always asking about them. Do you have any in America that are really perfected?"—*From an executive of the Electrical Association for Women.*

BY DOROTHY DIGNAM

Special European Correspondent

I'VE just come into Londontown from a backwards direction. Not straight up from the boat dock as most Americans come. But making first a circle of representative smaller towns and then approaching the smoky citadel from much the same direction that young Will Shakespeare must have taken when he left his wife at Hathaway Cottage and tramped into town to earn his fortune.

London stands in the same relation to England as New York to the United States. An electrical survey in New York wouldn't tell you much about the dealer situation in Coshocton, Ohio.

So I picked my towns through rural and industrial England with the idea of their varying size and class of population. And then came into London, the fountainhead of information, to sum up what I had learned about the present-day English market for the electrical appliances that we make so extensively—and sell so intensively in America.

All through the green countryside of England I heard rumors of the great "power ring"—the "American capital" that was forcing its way into the electrical world of Great Britain—the competition for control and manufacturing supremacy.

"Cheap Power" in England

BRIEFLY, however, the power situation seems to be this: The Government-appointed Central Electricity Board has proved itself to be an acting and not a debating body. These gentlemen are earnestly and actively at work.

What was, a year or so ago, a vast dream of coordinated power for the whole of Great Britain is today within realization. In Scotland, power is already being generated under the new arrangement and three other districts are about to be opened up. Steam power is being generated on a wholesale scale; transmission towers are stalking across the fox-hunting pastures of Merrie Old England, and instead of 152 separate generating stations in one district—152 stations working independently and sending out 152 different voltages at 152 different rates (almost), something like 30 modern well-equipped stations will eventually supply a standard voltage to that entire area, and the rate to the consumer if not materially reduced will at least be within reason and based on the one-price-to-everybody scale.

More Electricity Available

THE electrical manufacturer wants to know if this really means an abundance of cheap power in England with a corresponding demand for everything electrical in the home.

It does mean more electricity available but it doesn't mean cheaper rates—for everybody. Some parts of England today couldn't very well expect cheaper rates. A friend of mine living in the London area is only paying one cent per kilowatt-hour. She is perfectly aware that the operations of the Central Electricity Board (which, by the way, can't begin until 1930 in the London area because of existing charters) will not give her cheaper electricity.

However, friends of hers across town who are paying as high as sixteen cents per kilowatt-hour for their lighting are going to notice a big difference in the new rates. And these folks will then be in the market for those electrical appliances that they can't now afford because of the cost of operation.

Standardizing Plugs and Sockets

IN addition to rates and voltages several other things are being standardized over here. And they needed it! Plugs and sockets, for instance. The women are after the manufacturers on this score.

Women are tired of living in houses where all the outlets are made for three-blade plugs and all the appliances they buy have two-blade plugs. You've heard of the London electrical boy who brings seven kinds of plugs in his jeans when he comes to connect a floor lamp! He's not an exaggeration—but he's going to be an apparition, some day!

So with more electricity generated and transmitted. With more houses wired, with uniform rates which should be eventually lower than the average rate today, and with a movement toward standardizing plugs, sockets and outlets, this country would seem to be setting its house in order for electrical homemaking on a broad scale.

British Manufacturer's Preparedness

NOW, what is the British manufacturer's attitude toward this coming opportunity? He is building ten-acre plants at Birmingham for turning out in mass production the very sort of irons, toasters and percolators, heaters, washers, and cleaners that we pride ourselves on making in America.

He is keenly alert to existing sentiment about buying British-made goods and employing British labor. He is active in getting the cities placarded with "Buy British Electricwares" and other pertinent persuasions. He is effecting better relations between manufacturer and dealer, and dealer and power supply company. He is a busy man, this British manufacturer.

Ranged along near him are the united groups who manufacture electrical goods in Great Britain but are darkly supposed to have American "backing." They're enterprising too, and turning out first rate lines of electrical appliances. And thirdly, we find the well-known American brands manufactured in Canada, and sent into Great Britain with newspaper advertising, door-to-door salesmen, special offers,

Demand *in* England?

"IT'S too damp most of the time in England to dry wash outdoors, and a combination washer-dryer means that you don't have the wet clothes hanging around in the house. You want to know your market over here and then fill the needs." ***—From a member of the American Commercial Staff, London.***

"I WISH someone would give us a cheaper electric refrigerator. We have heard that a British firm is working on that now. It's pretty hard over here to make people see what they are getting for their £50 in the present refrigerator models."*—From an electrical dealer in Southampton.*

Miss Dignam was for five years associate editor of the monthly advertising service furnished by The Society for Electrical Development and for seven years was advertising copywriter for the Commonwealth Edison Electric Shops in Chicago

free demonstrations and all the venerated bohum of an American sales campaign!

John Bull is always a gentleman! He doesn't throw you out by the scruff of the neck, but he does naturally resent some American sales practices. One British manufacturer told me that "dumping" was particularly disagreeable. Because England is a free trade country, and practically no duties are levied on electrical merchandise, the American manufacturer can "dump" on the British market any surplus he may have on hand, and sell for any price he can get, plus freight. The British manufacturer is, of course, confronted with high tariff in our country and for export business he must look to the British provinces and dominions. He has, too, the competition of cheaper price (and, of course, more cheaply made) Continental merchandise, so his path isn't a bed of roses even in a garden-like land where crimson ramblers bloom three times a summer!

Now all this doesn't seem to open a paradise of promise to the American manufacturer. But when we consider the dealer situation—the Stars and Stripes begin to wave!

I haven't opened a dealer's door in England that familiar American appliances didn't fairly hop off the shelves at me.

American appliances certainly have the distribution, and prices, in many instances, are only a trifle above what I've written down so many times at home in preparing dealer advertising.

Reputation of American Products

IT'S the American nationally advertised brands that I find here, of course. And naturally, these names are more or less familiar in England. Dealers stock what they can sell—here, as everywhere else, and American washers, cleaners, refrigerators, have an enviable reputation.

I hope this good name may never be tarnished. The Bureau of Foreign and Domestic Commerce reminds American manufacturers that the increased sale of electricware to Great Britain may be expected to consist of the better and more expensive appliances. Also it will include the new inventions and improved devices such as the heat-controlled electric iron.

However, electrical retailing over here is not a get-rich-quick business. In some outstanding cases, the dealer may have a well-trimmed window and a well-arranged store. He has made a trip to "The States." He has opened a separate refrigerator department. He will leave a thriving

This central station store at Hackney, near London, is stocked almost entirely by a British manufacturer. Note the permanent stage for demonstrations of appliances. It is equipped with wings and floodlights. At either side, in front of the stage, in glass recesses are rooms in a model electrical home. There is always a great deal to look at in this admirable layout at Hackney

business to his son, but the average small-towner plugs away with less support than he gets in America, and does a slowly increasing business. His stock, at first glance, seems to number six portable lamps to one iron or toaster. This may be good merchandising after all, because the English home-maker would be more likely to come into the store and look at the lamps than she would to inquire if there were any electrical means by which she could toast bread at the table!

Yet, without elaborate displays as we know them, without much demonstrating except by American manufacturers, and with almost no dealer day-by-day advertising, the demand for electricwares is steadily increasing.

The Central Station Merchandiser

EVERYWHERE I heard apologies for being "slightly torn up just now—enlarging the department . . . come back when we get the new section opened . . . there'll be more of a story for you here, Miss, when our new stock comes in." All this indicates progress, and opportunity for America on a basis of fair trade.

I have been talking of the independent electrical dealer and contractor-dealer. Now let us consider the central station merchandiser.

Every central station in America, presumably, is interested in getting more appliances into the home. If they don't merchandise direct, they help support some association that promotes such load building. But over here where small isolated stations get as much as "a shilling a unit" for lighting (25c. per kilowatt hour) business is extremely profitable without bothering to promote the sale of electric ranges and other "current consumers."

The advent of the Electricity Supply Board, however, straightening out all these irregularities of rate, will leave many power companies looking for increased load through heating appliance sales and the new power act gives all central stations free rein to wire houses and sell equipment.

This inevitable get-more-appliances-into-use campaign is already beginning in the Northern counties. In fact, I just heard of a central station that is giving irons gratis to every customer. And when you have your house newly wired by the power company, you can choose any one of a variety of appliances as a gift—a "starter" for the home electrical.

Among the central stations that are already merchandising, the "hire" system still broods with expansive and expensive wings. The "hire" system is the death-blow of the electrical dealer. It means that the power company will install an electric range or a fireplace heater in your home for a few dollars a year rental. Why buy an appliance when you can rent one so cheaply and demand a new type every little while?

Central Stations Want Better Class Goods

THIS thing has been done to death in the gas industry! I have the word of a gas association official on that very point and the practice is not going to grip the electrical industry in any such manner. It means wholesale orders for the manufacturer but demands an amount of invested capital that might well swamp the power supply company.

Anyway, it won't be necessary for the central station to "hire" in the future. England has awakened to the delights of the deferred payment! British trade interests today are particularly keen on developing this partial payment business, and just since I've been in London the papers have published the views of conservative English bankers who laud the time-payment privilege as a means to systematic saving, better equipped homes, a healthy circulation of money and more fun in life all around.

So, the American manufacturer may look to the central station store as another outlet for his products, especially if he sends over the better class of goods. "They simply won't touch the cheap Continental stuff." I was told again and again. "You'll find it in the electrical stores and the department stores, but not in the central station."

And now for the woman purchaser of things electrical! This is where my report should have started—and indeed would have started if I were not myself a woman who must

(*Continued on page* 306)

THE floor lamp and floor heater in the electrical home of a British manufacturer, above, work in unison, both giving light and warmth. A British manufacturer has just made an interesting installation in St. George's Chapel, in Windsor Castle, shown at the right. Lamps of 200-400 watts in the shielded fixtures furnish both light and heat. The lamps are shaded with copper so that a glow akin to sunlight is produced. This electrical installation marks a great advance in English church lighting

Seventh Power Show Engineers' FORUM

The Seventh Annual Power Show proved by its large attendance and large number of exhibitors that expositions of this sort are growing in favor

IN ancient times word of mouth discussion was the general method of spreading information. Today this method is augmented by the radio, newspapers, magazines, motion pictures and numerous other devices in a most scientific and comprehensive manner. Looking back over the history of the progress of science and business we find that either the germ of every world-important idea or its culmination has been the result of the interchange of ideas, many of which were brought about by discussions at conventions and expositions.

Conventions and expositions are more popular today than ever before because of the important part they play in our political, business and scientific life. Through them organizations meet to determine upon policies, interchange ideas and adopt methods for the betterment of their business.

An exposition, to be successful and beneficial to those who patronize it, must reflect the utmost of progress of the industries it represents and must be comprehensive in every way. Such a display is the National Exposition of Power and Mechanical Engineering, held in Grand Central Palace, New York.

This exposition, as seen by an engineer, covers the entire field of power generation and mechanical engineering in general, with a thoroughness of detail which is astonishing. It represents a nation-wide gathering of exhibitors, and contains as complete and extensive a collection of things related to the subject as is to be found anywhere. Every conceivable device, process or correlated accessory is represented, from the actual power generators, down to those things which seem to have only a meagre claim to relation with the subject.

The exposition is a sort of melting pot; visitors and exhibitors are afforded the opportunity of becoming better acquainted, and of spreading a feeling of good fellowship. Competitive business is placed on a more intimate footing, and better feeling is certain to exist by virtue of the common interest. Business acquaintance between producer and consumer is fostered under unique conditions, because unsurpassed opportunity is offered to see, to compare, and to understand the different kindred products or processes.

Aside from the commercial aspect, there are many valuable opportunities which the exposition offers, that only indirectly contribute toward the common end. To those persons who are not in intimate contact with mechanical engineering there is the opportunity to extend their knowledge and enable them to see new possibilities. The exposition may be looked upon as an idea exchange, for it fosters new ideas, which may be the source of new trends of thought. To those who are entering the engineering field, the opportunity is offered to avail themselves of a supplementary education and to absorb information which in time will be invaluable.

"THE exposition is a sort of melting pot; visitors and exhibitors are afforded the opportunity of becoming better acquainted, and of spreading a feeling of good fellowship. Competitive business is placed on a more intimate footing, and better feeling is certain to exist by virtue of the common interest. Business acquaintance between producer and consumer is fostered under unique conditions, because unsurpassed opportunity is offered to see, to compare, and to understand the different kindred products or processes.

"The Power Show covers the entire field of power generation and mechanical engineering in general, with a thoroughness of detail which is astonishing. It represents a nation-wide gathering of exhibitors, and contains as complete and extensive a collection of things related to the subject as is to be found anywhere. Every conceivable device, process or correlated accessory is represented, from actual power generators down to those things which seem to have only a meagre claim to relation with the subject."

Exhibiting at these annual power shows involves certain legitimate expenses, such as rental of space, cost of decoration and arrangement of display, etc. Most exhibitors now look upon this expenditure as so much invested in advertising. Some companies in planning their advertising campaign for the year, allot so much for the cost of exhibiting at industrial expositions. Indeed, the exposition is one of the earliest forms of advertising, for it is nothing more than a modernization and specialization of the ancient fairs which were held at specified times, and to which caravans of many sorts of merchandise converged.

In ancient times it was not unusual for pilgrimages to wend their ways on horse or on foot for hundreds of miles to display their wares at one of these fairs. Nowadays, between the railroad, airplane, steamship and motor truck transport, the fair is reached expeditiously.

One outstanding feature of the industrial exposition is that it enables so many people to see certain products or improvements upon standard products for the first time. It likewise affords comparison with dozens of other similar articles produced by competitive concerns. It is this instructive element which makes expositions great advertising and selling media and is, as a bulk, advertising of an educational type. A visitor at the exposition who does not happen to understand the operation of a certain device will not hesitate to ask questions of the demonstrator or salesman, as he knows the demonstrator will be interested in giving information. But the same visitor may be backward about going to a company's office or salesroom to make an inquiry. He may not have the time, and also may not wish to put himself under apparent obligation. At an exposition a visitor never feels under obligation.

The acid test for an industrial exposition, such as the Power Show, is that about 90 per cent of the exhibitors come back each season. If it did not pay to exhibit year after year, this percentage would not do it.

More than 540 exhibits contributed to make the 1928 Power Exposition the greatest of its kind ever held. Every available square foot of space on four floors of Grand Central Palace was occupied.

From a little one-floor show held back in 1922, the National Power Exposition has grown steadily until now it is considered the largest industrial exhibition held in New York City. In 1922 there were only 105 exhibitors and the attendance was 47,589. In 1923 the exposition grew so that another floor of the Palace had to be utilized. The number of exhibitors rose to 262 and the attendance figures jumped to 67,079. Another floor had to be added for the third renewal of the show in 1924 for the number of exhibitors mounted to 380, while the attendance increased to 79,521. There were 401 exhibitors displaying products on three floors at the 1925 show and the attendance jumped to 84,599. So great was the interest in the show in 1926 that four floors of the Palace had to be pressed into service to house the 490 exhibits. The attendance that year was 103,030. In 1927 it was believed that the saturation point was reached so far as exhibitors was concerned for the number was 530. The attendance, too, reached a high water mark, and it was thought it could not be broken. More than 110,000 people visited the exposition in 1927, but that mark is understood to have been eclipsed this year. Visitors from every country registered at the Power Show, for American industrial products are now in great demand. Products that have lifted American industry to its present high plane were displayed in a thousand ramifications. The general public is not admitted to the show, which is free to engineers, business executives and others interested in engineering and allied subjects.

Power Show Unique Form of Advertising

ANY advertising medium that can show a 90 per cent renewal list has delivered the goods for the advertisers. These exhibitors renew their contracts, not on theory but upon the results they gained in the preceding show.

For instance: The exposition brings the prospect in personal contact with the seller on the seller's own ground. The prospect is permitted to see an actual demonstration of the product—a selling force a hundred times more potent than words or even pictures. The exhibitors have the opportunity to learn how prospects react to the selling points his publication advertising is making—an invaluable guide to future advertising effort. The exhibitor learns how his prospects react to competitive products, for the prospect is there "to see 'em all."

"Exposition advertising," says Ray Watson, in *Advertising & Selling*, "has a distinct place in the marketing scheme; and because of its definite proved power deserves thorough investigation from those whose main interest, after all, is the pursuit of profitable sales."

Profitable sales and good will result from the direct contacts made by salesmen connected with any exhibit that attracts the attention and holds the interest of visitors to the exposition.

Just how far-reaching are the sales made at industrial expositions cannot be determined, but the following letter received by the International Exposition Company on October 27, 1928, will illustrate the selling possibilities expositions afford:

"It may interest you to know that at the Power Show about two years ago, interest was aroused on the part of the engineers of one of the largest synthetic ammonia manufacturing plants in the country in some of the equipment we had on exhibition.

"The initial order we received at our booth at that time amounted to $125. Since then we can state that we have done with this one concern alone business involving over $25,000.

"No doubt this will interest you and more particularly so in view of the fact that this is entirely unsolicited on your part."

Letters from engineers, business executives and others which tell the story of the Power Show have been received by the hundreds by the International Exposition Company. Excerpts from a few on file at the office of the company are as follows:

"I visited the Power Show for the first time, coming from Belgium to study American power plants. The Power Show gave me the best opportunity to come in touch with American manufacturers and to know the apparatus they put on the market."

"The expositions have been wonderfully prepared and arranged and interest me very much. I meet manufacturers who explain their products more fully than can be gathered from correspondence, catalogs and blue prints. The time occupied is spent profitably."

"We visited your Exposition last year to keep pace with new developments and thus be prepared to meet any need for new equipment which might arise at our plant."

Analysis of Registered Visitors Sixth National Exposition of Power and Mechanical Engineering 1927

Industries or Products Represented by Visitors

Architects	232
Automobiles	201
Aviation	56
Building and Construction	840
Ceramic Industries	151
Chemicals and Chemical Products	613
Cleaning Industries	128
Coal and Coke	290
Colleges and Schools	479
Electrical Equipment Manufacturers	1187
Engineering	1805
Food Manufacturers	465
Furniture Manufacturers	39
General Industry (Servicing and supplying all industries)	1033
Heating and Plumbing Contractors and Engineers	929
Hotels, Hospitals, etc	296
Instruments of Precision, Control, etc	406
Leather (Hides, Skins, Fur and Products)	53
Lumber and Wood Products	122
Machinery: Accessories and Supplies	1027
Machinery: Heavy Equipment	3292
Metallurgy	494
Metal Products (Founding, Forging, Casting, Fabricating)	583
Mining and Minerals	257
Miscellaneous Manufacturing	664
Oils, Fats and Waxes	50
Paints, Varnishes, Printing Inks, etc	117
Paper (305), Paper Products (90)	395
Petroleum and Its Products	540
Photographic and Motion Picture Industries	90
Printing, Publishing, Lithographing, etc	129
Public Utilities	3661
Publications	339
Realty Operators and Managers	124
Refractories Manufacturers	108
Refrigeration and Ice Making	165
Rubber	31
Shipbuilding and Marine	238
Sporting Goods	21
Steel and Iron (Manufacturers and Fabricators)	380
Textiles (310) and Garments (152)	462
Tools and Machine Tool Builders	234
Tobacco Manufacturers	26
Water Purification and Treatment	34
Welding	55
Government Departments, U. S.	207
Unclassified	1688
Total	24,736

TRUCKING Materials in Electrical Factories

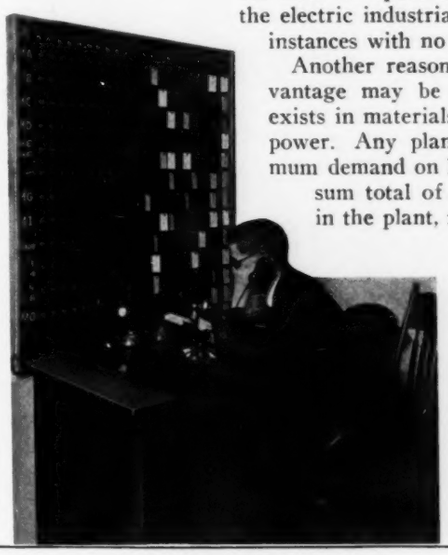
A materials handling department, divorced from production, gives maximum results as shown in the records of two large manufacturing plants

By C. B. Crockett

The Society for Electrical Development, Inc.

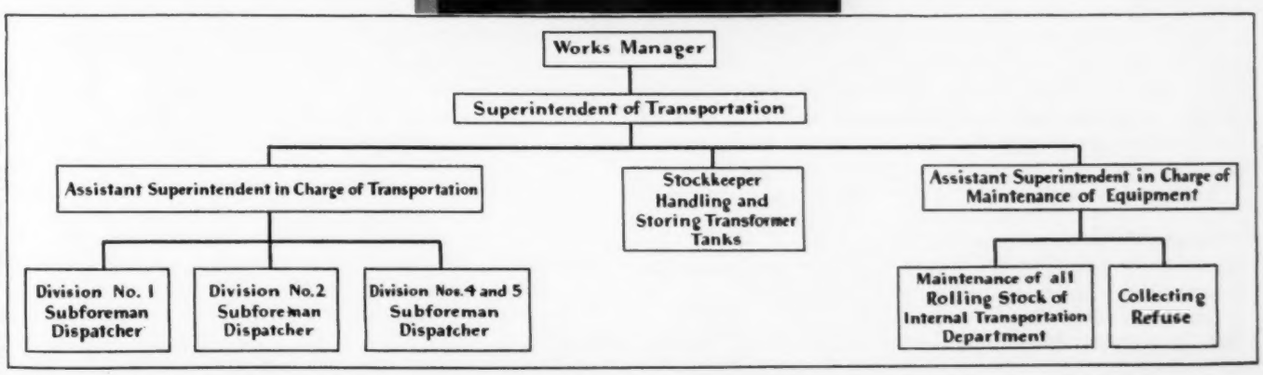
"I FEEL that the large increases in wages since the war have resulted in a notable improvement in mechanical handling. I also feel that the ability of the industry to continue to pay high wages has been made possible by mechanical handling." This is the statement of Edward N. Hurley, chairman of the Electric Household Utilities Corporation. Mechanical handling has come to mean more than the substitution of mechanical power for strong backed but weak brained labor. The realization of the plant executive that it is the "system" as well as the equipment that earns the dividends definitely places materials handling as a sub-division of management. The practice of selling a single piece of equipment to perform a specific task is being displaced by a complete study of the materials handling system in the plant and the revision of entire processes.

Why is it that systems of mobile transportation seem to find favor with manufacturers in the electrical industry? From the materials handling standpoint there are several features of the electrical manufacturing industry that point definitely in that direction. The plant often has a variety of products differing in weight, size, quantity and requirements in handling. Plants are generally extensive and with widely separated departments from which material has to be brought for the assembling process. The industry is in a condition of constant change and improvement with larger sizes, different products, rearranged manufacturing facilities appearing more often than is the case with older industries. All the above factors definitely influence the buyer to select his equipment with an eye to flexibility. If a different product is to be manufactured or several departments rearranged, the cost of such changes is large enough without the additional burden of heavy charges for new transportation equipment. Mobile equipment like the electric industrial truck or tractor can be used in such instances with no expenditures for changes.



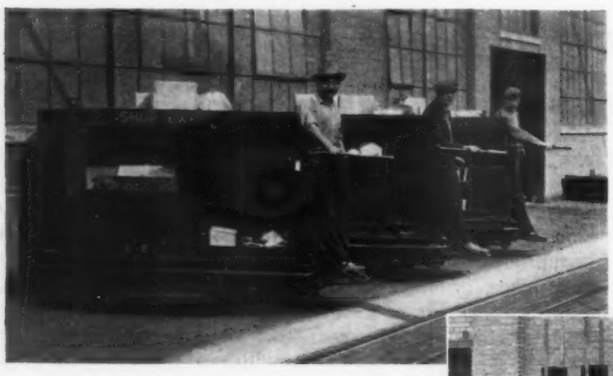
Another reason for desiring flexibility is so that advantage may be taken of the diversity factor which exists in materials handling as it does in the demand for power. Any plant engineer will know that the maximum demand on his power plant is usually less than the sum total of the rated capacities of all the motors in the plant, nor is it often that capacity is provided for such an unlikely condition. The same is true of transportation equipment provided that equipment can be of service first in one part of the plant and then in another.

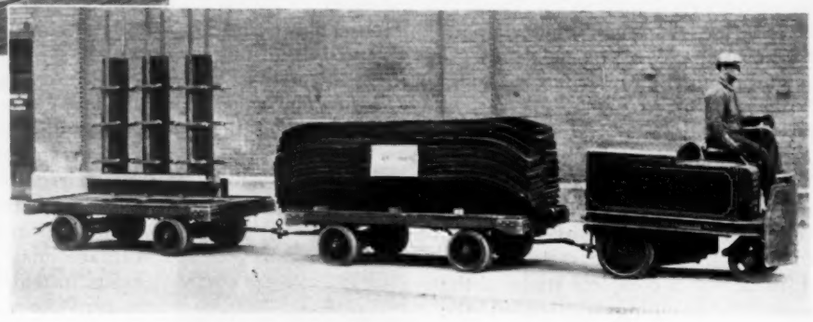
Flexible and mobile systems of plant transportation have therefore these advantages, but as is so often the case these are not an unadulterated blessing. Nearly every advantage is offset to some degree


Works Manager
Superintendent of Transportation
Assistant Superintendent in Charge of Transportation
Stockkeeper Handling and Storing Transformer Tanks
Assistant Superintendent in Charge of Maintenance of Equipment
Division No. 1 Subforeman Dispatcher
Division No. 2 Subforeman Dispatcher
Division Nos. 4 and 5 Subforeman Dispatcher
Maintenance of all Rolling Stock of Internal Transportation Department
Collecting Refuse

A view of a dispatching office at the Westinghouse plant, East Pittsburgh, is pictured above. The white slips on the control board are "truck service requests," the horizontal lines show plant locations, and the vertical rows designate half-hour intervals. The chart shows the organization supervising internal transportation in one large plant of the General Electric Company

with a corresponding disadvantage and in this case the disadvantage is that there has to be the introduction of the human element to control and direct the mechanical power. A heavy investment in conveyor equipment in one part of the plant may be such a burden that another part of the plant may have to do without mechanical handling, but at the same time the plant manager is sure when the work comes along that the conveyor will be there to handle it and that a turn of the speed controller will take care of any increased demand that he may care to make. The industrial truck or tractor can pick up work as required in any part of the plant but will only be fully effective if the driver of the truck is interested in getting the maximum work out of his equipment.





THE shop-express, which maintains a four-hour parcel post service throughout the Westinghouse plant, is shown above. The view to the right pictures the transportation of transformer cores by tractor and trailer in one of the manufacturing plants of the General Electric Company

What mobile equipment needs therefore is adequate supervision, a co-ordinated system and an incentive for the human element that will be productive of maximum results. Adequate supervision implies adequate knowledge of materials handling, a co-ordinated system under which all material handling will be segregated and controlled by a capable head and a method of payment or other incentive which will insure maximum performance by the human element of the transportation system.

Materials handling has for so many years been the by-product of production that it has, in nearly all cases, developed with the particular processes and practices of an industry. Let us make a comparison for a moment with the problem of power supply in the plant. The power engineer of an industrial plant is a specialist in his work, is familiar with the progress made throughout industry and is responsible only to the management of the entire plant. He is always looking for advances in the practice of other industries which he may apply to his own problems, he has the help of constant research into the theory of thermo dynamics and the consulting engineer is his constant aid and adviser in the solution of his practical problems.

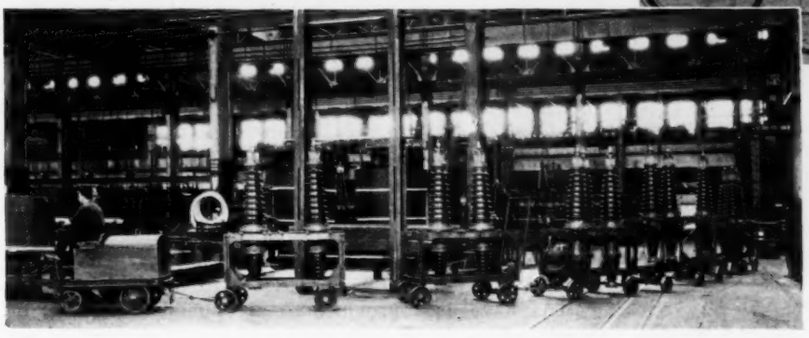
Materials handling has in many cases been left to the ingenuity of a shop foreman, no specialist has been employed, no attempt has been made to investigate the progress made by other industries nor has any research or the aid of the consulting engineer been employed in solving the problem. This is true, or at least has been true until recently, in spite of the fact that probably 80 per cent of the unskilled labor payroll is expended for the movement of material. As a result of letting the development of material handling methods rest with men primarily concerned with special production problems, the development of handling methods connected with, and inseparable from, the technical production problems of the particular industry have far outstripped the development of methods for straight handling operations. In other words the development of handling methods has been a purely industrial problem with no attempt to relate the work going on in different phases of American manufacturing. That this condition has existed and, to a large degree, still exists is unfortunate as the handling processes of different industries once divorced from the technical process of production may show a remarkable similarity. The handling of materials in the manufacture of dry batteries may have little in common with those employed in the canning industry, but once the cans or the batteries are placed in cartons or cases of approximately the same size and weight the methods used in either industry might be perfectly applicable to the other.

It will be chiefly through the employment of a man whose sole responsibility is the low cost movement of material through the plant that a concern in the electrical manufacturing business will be able to co-ordinate the various problems encountered in his own plant and be assured that advances in methods and equipment made throughout the sweep of American industry will be known and the results applied to lower the costs of movement in his own plant. For that reason the author has elected to describe the organizations existing in the plants of two of the largest manufacturers in the field; namely the East Pittsburgh plant of the Westinghouse Electric and Manufacturing Company and one of the plants of the General Electric Company. The author is indebted to Mr. C. A. Fike and Mr. E. J. Mills, Superintendents of Internal Transportation at the respective plants, for much of the operating data.

The transportation problem faced by the Westinghouse Electric and Manufacturing Company was complicated by the immense size of the plant and the amount of material to be moved; it should be remembered however, that the problem of the smaller plant does not differ essentially, as the large plant is really an assembly of smaller plants and the difference in transportation equipment will be one of number rather than type and size. The East Pittsburgh plant has a floor area of about 4,000,000 sq. ft. with one nine-story, three four-story, and the remainder two-story buildings. The material handled varies from huge castings and generator parts to the smallest detail of some control mechanism. In order to gain a clear picture of how the mobile electric industrial trucks and tractors fit into the picture, the general layout of the Plant Transportation Department will have to be understood. This department is divided into six branches according to type of equipment used. The following are the titles of the subdivisions: Standard-Gage Railroad, Automobiles and Trucks (Gasoline), Industrial Railway, Cranes, Elevators, and Electric Industrial Trucks. Thus problems involving more than one type of equipment are co-ordinated and time saved in the

transfer of material from one agency to the other.

The industrial truck system used is that of district dispatch with the dispatch offices located strategically throughout the plant. This system is supplemented by a shop-express system and a refuse collecting system which operate on a regular schedule, the latter operation taking place at night. There are two elements of shop handling which work in opposition to each other, the first is that of keeping the trucks operating with capacity loads and the second is that of time. Unless the system is so organized that there is due regard for the former, the production men in the plant will sacrifice the loss due to small loads for the sake of having the material move fast. Over a long period of time records have been kept which show the eact number of trucks needed to handle a certain division of the plant and still keep the load on the individual trucks up to an efficient standard. A close check is kept on truck loadings and only the exact number are kept in service, the others going into reserve to be called on as required. The dispatching office receives requests by telephone, combines loads wherever possible and takes care of all regular work which is performed on a regular schedule and which requires no order. The dispatch office reports at regular intervals to the works transportation office the number of orders waiting to be filled, and trucks are shifted or called from reserve as the occasion demands. Provision is also made for return loads either through the district dispatch or by communciation with other dispatchers.



ABOVE is a lift truck with three trailers, illustrating the variety of materials handled. Large bushings, as are shown to the left, require special care in handling. By means of tractor and special trailers, one man moves twelve with greater speed than three men moving two by hand

The industrial truck system operating through the dispatch offices is also responsible for the delivery of materials from the storeroom to the different manufacturing sections. The sections which need material telephone the stockroom where the proper requisitions are made out, the material removed from the stock bins and loaded on skid platforms. The skid platforms are delivered by the electric trucks which are ordered by the stockroom. The material which in a great many cases is in small lots is then delivered in one trip rather than having each section send its own truck or messenger and insures the full loading of the transportation equipment. Certain trucks are regularly employed in special tasks: one delivers the pay envelopes to the different pay stations throughout the plant, another is equipped for electrical and mechanical repairs while tiering or high-lift trucks are employed in the punch press department for the handling of heavy dies to and from the machines.

Three other trucks operate as shop-expresses and run on regular schedules, giving a four hour service to the entire East Pittsburgh plant and all other plants in the Pittsburgh district. About 900 packages the same size and weight as a parcel post package are handled each day on this schedule at a cost of about three cents each.

Skids and lift platforms have been designed to fit the exact requirements of the work, trailers are used in connection with the trucks wherever economical and every opportunity has been developed both through a study of other electrical plants and of methods in other industries. The question of the cost of speed as against slower but more efficient movement has been worked out for the lowest overall cost. These are all factors which were mentioned in the first part of the article as requiring the attention of a materials handling expert in the plant.

While the co-ordination of the different types of equipment and the different movements in the plant went far in reducing the handling costs it was still believed that there could be a further increase in ton miles per truck per day. This is the measuring stick of transportation efficiency within the plant just as ton miles per train per day is the criterion of efficiency in railroad transportation. To further cut costs it was necessary to increase the personal efficiency of the truck driver. The work was scattered over a large plant, supervision of every operator was impossible and investigation as to delays or waits for cranes or elevator service proved to be fruitless after they had occurred. It was therefore felt that an incentive wage plan would help eliminate delays and stimulate the truck drivers to find for themselves the cause of any delay at the time it occurred.

A group bonus system was employed for the payment of industrial truck drivers based on the number of loads handled per day. As these loads were figured from the requests made by the different sections for transportation service it was to the interest of the truck driver to combine as many requests as possible on the same trip. Time studies were taken for each manufacturing section which showed the loading, traveling, unloading and delay time for each type of truck and from this an average time was secured. The next step was to secure a time value for the average load in the district. From the foregoing time studies and past records of work performed in each district the average number of loads per day was determined for each district. This figure was used as a multiplier of the time value for an average load. The total divided by the total number of loads gave a base time value for each load or call on the dispatch board. The payments are figured from the "truck service" requisitions which are handed to the truck operator at the time of picking up the order and are turned in by him at the dispatching office.

In the case of the shop-express service much the same system is used except that there are penalties for damage to parcels, delivery behind schedule (the driver punches a time clock along his route) and for wrong delivery. A

stub is used in the express service which corresponds to the "truck service" requisition.

Aside from the direct saving resulting from having one organization in charge of all plant transportation there are other advantages which at first are not apparent. As an example, the production department and the planning department have but one agency to deal with even though the work may require several different types of equipment and pass through several different manufacturing sections.

A view of a standard type electric truck used by the electrical equipment maintenance department in a large manufacturing plant. The racks hold small parts and various tools

Again in making new layouts for new manufacturing processes or for a new product, the layout department has to consult with only one department to arrange for transportation facilities, in fact the transportation department has a very important voice in the layout of new facilities. In the third place, the system was made to perform so smoothly and swiftly that it practically eliminated the hand trucking of material between departments which would not have been the case had the system been slow or complicated with too much red tape. As a result of this service the transportation department has the backing and cooperation of every line supervisor in the plant.

The direct saving effected by this system is quickly shown. Before installing the system there were 88 trucks in operation in the plant, of which about six were standbys. After the system had been in operation long enough to become effective the number of trucks was reduced to 67, a reduction of 15 trucks. The operating cost of a truck with driver is about $130 per month ($95 for the driver and $35 for the fixed and operating charges for the truck itself). This results in a gross saving of $1,950 per month from which must be subtracted an expense of $950 per month for running the dispatch stations which leaves a net saving of $1,000 per month. This is of course not taking into account the immense saving which accrues from the use of the trucks, but is merely the saving from having the plant transportation organized under an effective head. The fleet of trucks handles practically all of the hauling necessary except for very large pieces, which are handled by means of a crane, a locomotive and a locomotive crane.

One large plant of the General Electric Company comprises some thirty odd buildings and employs about 6000 workers. The products of the plant include transformers, lightning arresters, reactors, capacitors and small motors from ½ hp. to 10 hp. It will be seen from this that there is a continually varying demand placed on the internal transportation facilities, loads ranging from a few pounds of miscellaneous supplies to assembled transformer cores weighing 20 tons.

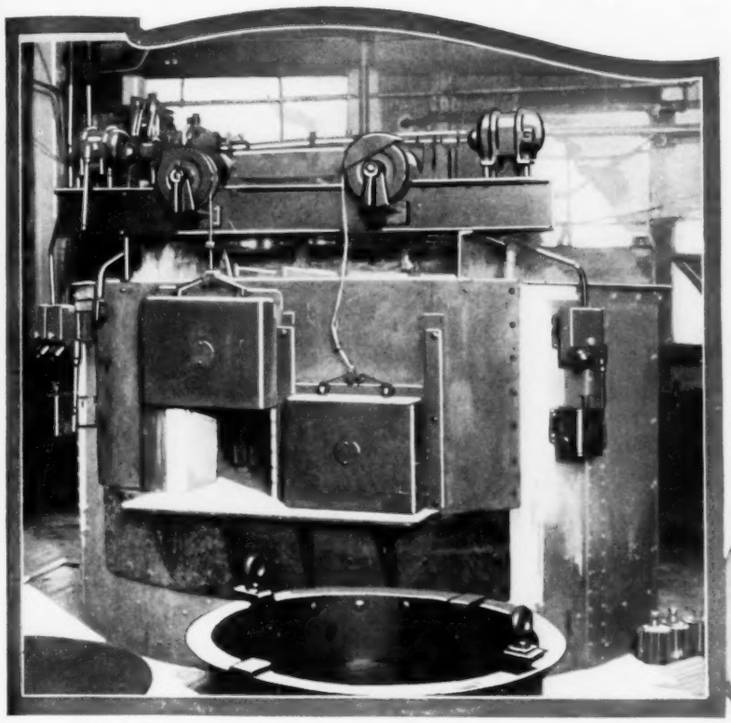
The management of this large plant purchased an electric tractor and 15 trailers for use in one of the divisions in 1919. The equipment saved $10,600 during the first year in service and proved so effective that this type of equipment has been made the backbone of the present system. The present fleet includes 18 electric tractors, 25 electric lift trucks, 15 electric baggage trucks, and four Fordson tractors. These are supplemented by 598 trailers, 1000 lift truck tote boxes and 400 lift truck platforms. For short distance movement 21 hand lift trucks are used. The heavy materials are handled by one electric traveling crane, one electric locomotive and one locomotive crane. It is interesting to note that in such a large plant only three of the larger types of equipment are found necessary, the vast majority of the work being handled by the mobile fleet.

The transportation organization consists of a superintendent of transportation reporting to the works manager, an assistant in charge of transportation, an assistant in charge of maintenance of equipment, and a stock-keeper who has charge of the handling and storage of transformer tanks. The actual transportation division is divided into three subdivisions with a sub-foreman dispatcher over each.

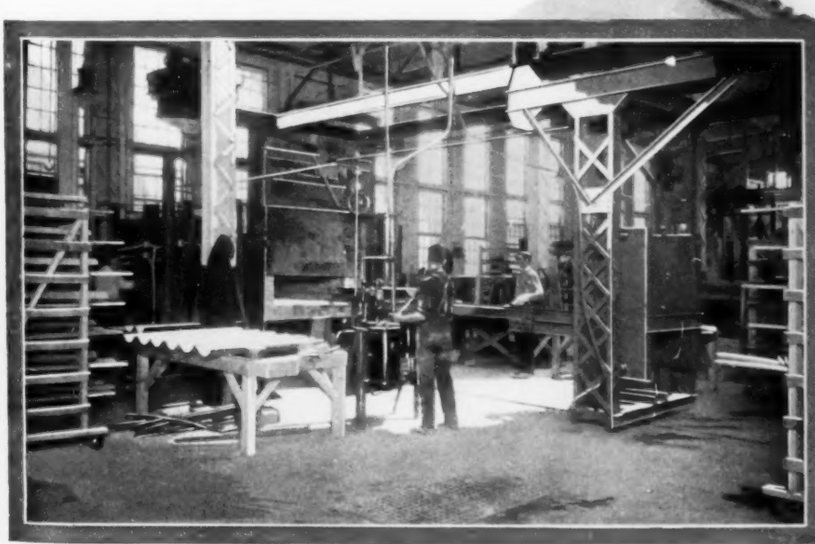
Material entering the plant in freight cars is unloaded at the various buildings with a view to bringing it as near as possible to the point of actual use. In general the material is loaded direct to trailers and remains on them until actually used. The tractor trailer system is employed wherever possible for inter-plant and inter-departmental movement. The lift truck or baggage truck is used with skid platforms or tote boxes where the material is smaller or where the material has to reach the upper floors by means of elevators. Again there is the case of the selection of the proper equipment by an expert and the co-ordination of the different types employed by the entire plant. Nearly all material is kept on trailers or skids during its progress through the different processes, the operator picking his material from one trailer or skid and placing it on another upon completion of the operation. In many cases special trailers have been provided to accommodate finished material such as large bushings but the total number of such special trailers only amounts to 25 per cent of those employed. So far has this development advanced that the total transportation organization for a plant employing 6000 men is limited to about 70 men (40 truckers, 20 helpers, six maintenance men and four other miscellaneous). Since the installation of the system and the use of mobile electric equipment the plant handling costs have been cut 25 per cent.

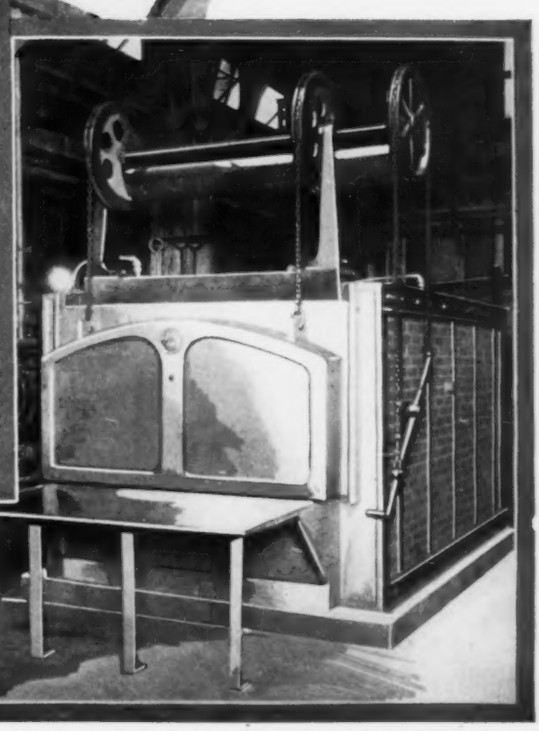
A specially constructed electric truck for the handling of spools of cable and wire. This particular truck is in use at a large manufacturing plant, where many spools are handled daily

Economies of Electric Heat *in Electrical Plants*

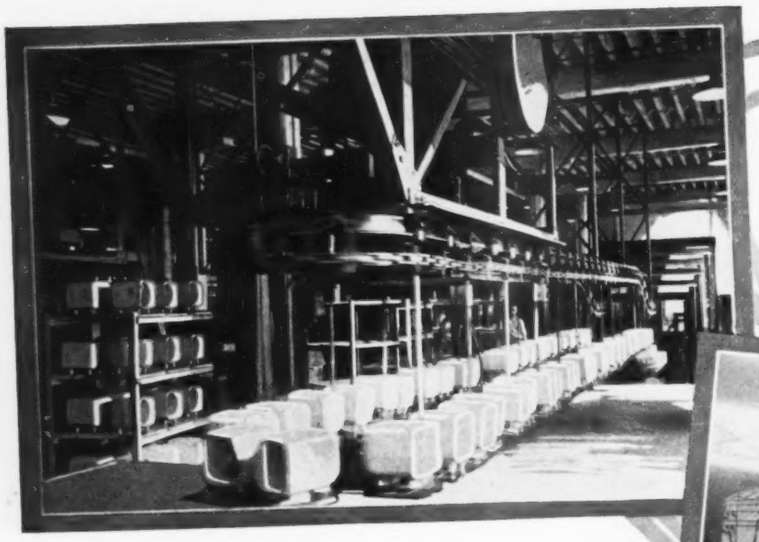


ABOVE is a rotary hearth furnace used for drawing operations in the heat treatment of gears and pinions for railway motors. To the right is a vertical cylindrical furnace for the same purpose. These two furnaces replaced a group of oil-fired furnaces resulting in a better product at lower cost





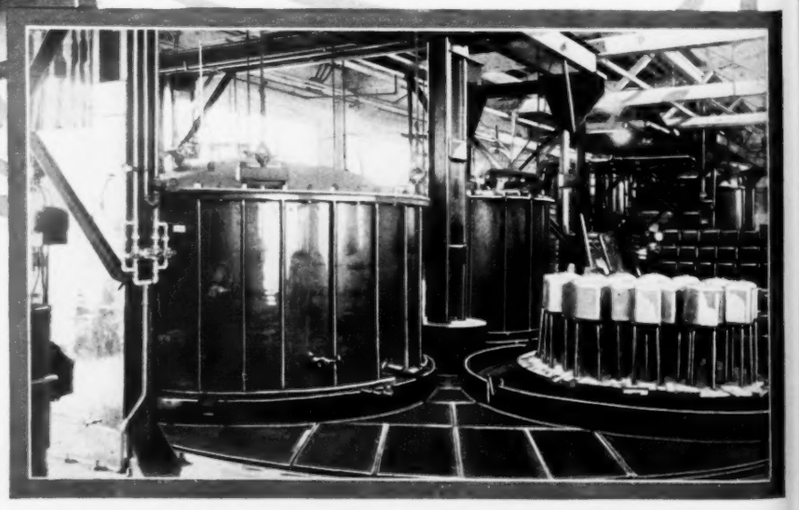
SEVERAL furnaces, such as that shown above, are used by the General Electric Company for firing vitreous-enameled coating on reflectors for incandescent lamps and for mercury-vapor lamps, as well as for miscellaneous parts that require such a finish. At the right is shown one of a group of four furnaces used for the heat treatment of gears and pinions for railway motors. The furnace shown at the right is used for the hardening operation



A CONTINUOUS conveyor furnace for vitreous enameling is shown at the left. Continuous conveyors are used extensively in modern industrial plants when the volume of material and the nature of the work to be done will permit handling by this means. Processes can be speeded up and considerable labor can be saved by well-designed conveyor systems. The hot zone of these furnaces is at the far end, and the work which is entering passes the outgoing work in the front chamber, where much heat is interchanged

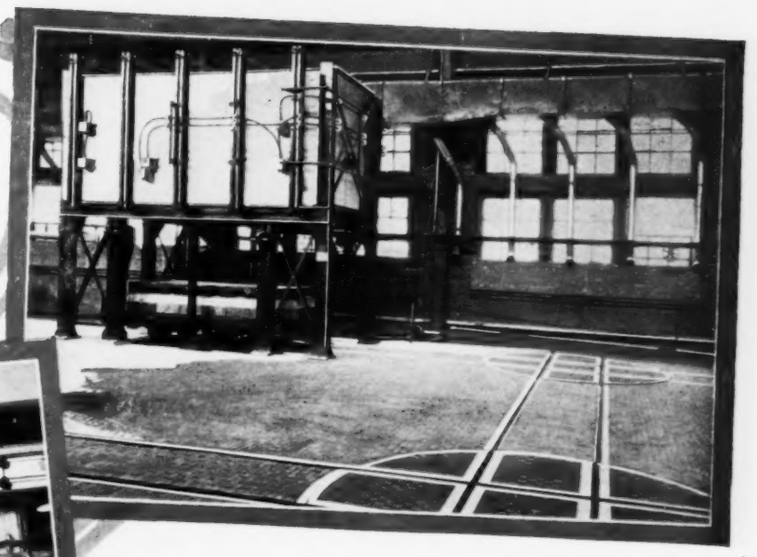
AT the right is shown a group of elevator furnaces for annealing sheet-steel for large transformers. Loaded cars are run under these furnaces and are raised into position by a hydraulic ram. They are equipped with several cars and a cooling chamber, so that one charge can be cooling and another loaded while the charge in the furnace is being heated

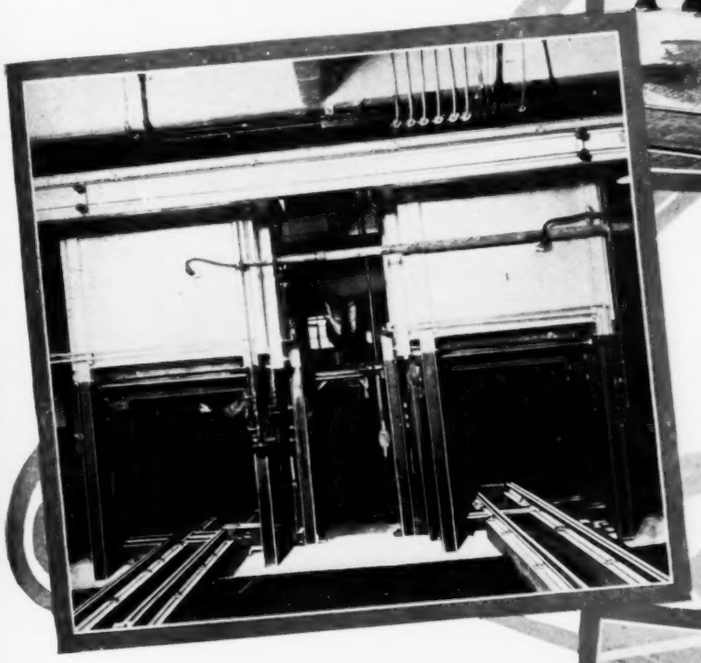
THE furnace at the left is used for baking carbon brushes for motors and generators. In the manufacture of carbon brushes, the carbon, in powder form, is mixed with suitable liquid binders and pressed into shape in molding machines. The blocks then require careful baking to develop the binder and to give the brushes the desired characteristics. In the baking operation, the temperature must be raised slowly and, preferably, at a definite rate, requiring several days to reach the baking temperature. Control of the furnace at the left is provided with time-rate instruments, which raise the temperature automatically at the prescribed rate



A THREE-STAGE brazing furnace for copper-brazing steel parts together is shown at the right. These parts are used in the manufacture of turbines, electric refrigerators, and other apparatus. The work must be heated and cooled in an atmosphere of protective gas, in order to prevent oxidation. The furnace consists of cylindrical heating and cooling chambers, both of which may be raised—and a turntable containing three platforms, one of which may be unloaded and loaded while the others are heating and cooling

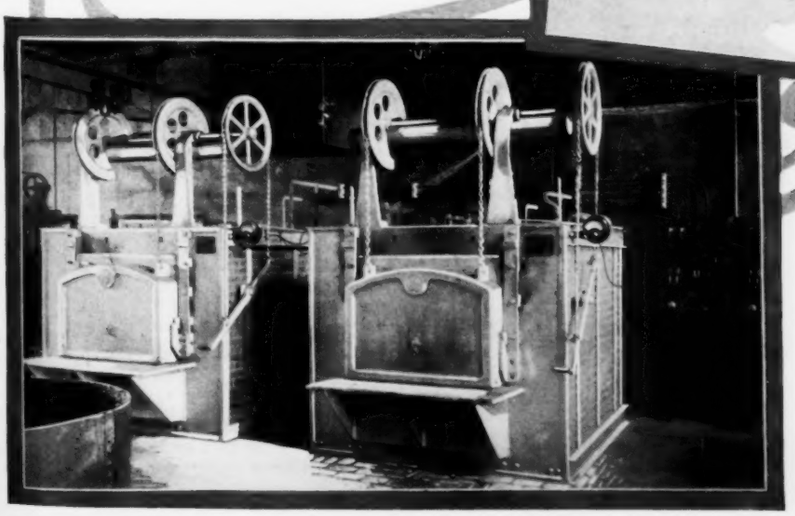
AT the right is shown an elevator-type annealing furnace for sheet steel. Prior to the installation of this furnace, lamination punchings were annealed in a group of oil-fired furnaces, being packed in heavy pots weighing nearly as much as the punchings themselves, in order to protect them from oxidation by the furnace atmosphere. A large amount of fuel was required to heat the pots and to force the heat through them to the punchings. The renewal cost of the pots was also a large item of expense





AT the left is a group of elevator-type annealing furnaces for annealing sheet-steel punchings for small transformers. Like the above furnace, this one does not require the use of pots, so that only the punchings are loaded on the cars. This permits heavier loading, a relatively short annealing time, and therefore, a much greater output for a given floor space. The cost per ton of electricity for annealing is less than the cost of oil, because there are no pots to be heated, and the space formerly used has been released for production purposes, as only a small part of it is required with the electric furnace

A BOX-TYPE furnace for vitreous-enameling the linings of electric refrigerators is shown at the right. There are four such furnaces in this room, used for the linings, legs, and other parts of electric refrigerators. A drying oven is located beside the furnace. Electric furnaces are particularly well suited to vitreous enameling. The atmosphere is clean; the temperature distribution is uniform; the response or "come-back" is quick from charge to charge, permitting a high output and yielding a product of exceptional uniformity. Forty-five to fifty parts per hour are put through these furnaces



TWO box-type furnaces for heat-treating dies and small parts are shown at the left. These replace a double-chamber gas furnace. There are eight electric furnaces in the room, some of which have been in operation since 1919. Most tool-room furnaces are idle much of the time, but are maintained at temperature ready for immediate use. The stand-by losses of electric furnaces are very small because of their well heat insulated walls. These furnaces cannot explode, are clean, safe, and comfortable for the employees

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Applying Insulating Materials to Coils and Windings

No. 8 of a Series of Insulating Varnishes and Impregnating Compounds

To obtain best results from the use of insulating materials the directions of the manufacturers and the specifications should be followed closely

By D. H. Braymer
Consulting Engineering Editor
Electrical Manufacturing

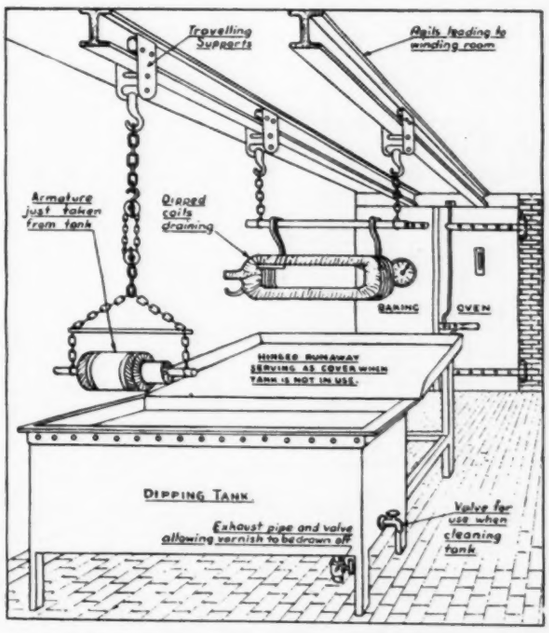
APPLICATION of insulating varnishes by the two most used methods, namely dipping and baking method and the vacuum impregnation method has been described in earlier articles of this series. In what follows practical information on procedure in handling varnishes will be discussed.

Preparing Windings For Varnish Treatment.—When applying insulating varnish to a complete winding, as in the case of a rewound motor, it is the custom in most repair shops to immerse the complete armature and also the complete motor stator with its winding in the insulating varnish. The reason for this practice is that the varnish penetrates into the slots and when it dries holds the armature coils in place by filling all the available space. This filling of all the air spaces in the slots prevents the entrance of dirt and moisture. It also seals the loose laminations so as to prevent vibration and covers all of the iron part of the core with a rust-proof coating. On the coils themselves, this dipping in the insulating varnish provides an additional coat of insulation and added protection in case coils have been bruised in handling when being inserted in the slots.

When coils are made up and stored, ready for use as needed, they become covered with dust and dirt and may have a certain amount of oil on them from handling with oily hands. It is advisable when these coils are inserted in slots to make sure that they are perfectly clean in order that the varnish application, when dipping the completed job, will thoroughly adhere to a clean surface. If the coils are simply dirty from dust this can be blown off with compressed air. In case there is considerable oil or grease on coils, this should be washed off with gasoline or benzine. After applying the gasoline, it is a good plan to heat the coils for 30 minutes in an oven to drive off the gasoline and any oil that may still cling to the coils. This procedure in cleaning coils applies particularly to coils which have been made up and thoroughly insulated ready for use in stators of A. C. machines and armatures of D. C. machines. Stator slots should be thoroughly cleaned by burning with a torch all material that sticks to the sides, then scraped and filed to make the slot surface smooth before slot insulation and coils are inserted.

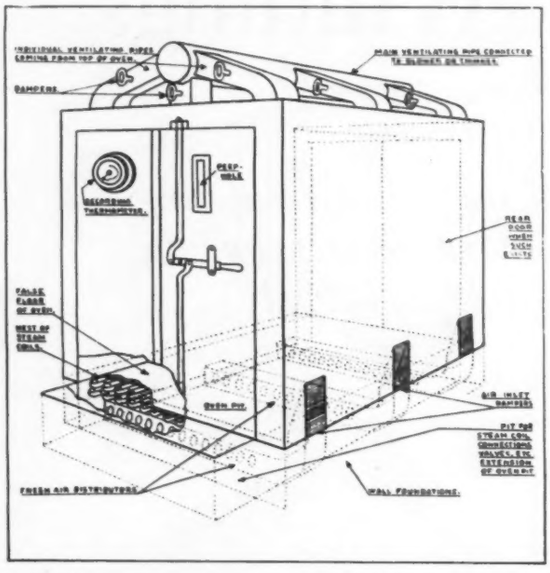
When gasoline for washing coils is used in a tank, the dirt and oil removed will settle to the bottom of the tank leaving the remaining gasoline fit to use again if the sediment is drawn off.

Dipping Tank For Coils and Small Stators—When coils and small stators are dipped in insulating varnish and then baked, the tank should be of such size as to completely immerse the stator or at least contain enough insulating varnish so that the heated parts which are dipped in the insulation and have been heated previous to this operation, will not overheat the varnish so as to cause the solvent to evaporate. Sheet steel tanks should be used and in no case zinc lined tanks, owing to the fact that zinc has a bad effect on insulating varnish. When dipping tanks are not in service, they should be provided with a cover. This cover should fit in a groove around the top of the tank filled with some liquid like linseed oil, so as to provide an air seal and prevent the evaporation of solvents in the varnish. This will also keep the tank free from dust and dirt. After the varnish in the dipping tank has been used three or four times, the tank should be emptied and the varnish strained through several thicknesses of close texture cloth. This will remove all dirt and oxidized varnish that may have accumulated.


Travelling Supports
Rails leading to winding room
Armature just taken from tank
Dipped coils draining
BAKING OVEN
HINGED RUNAWAY SERVING AS COVER WHEN TANK IS NOT IN USE.
DIPPING TANK
Exhaust pipe and valve allowing varnish to be drawn off
Valve for use when cleaning tank

A sketch of a convenient dipping and draining vat and a bake oven for the common types of electrical windings. These are simple in construction and are very efficient

After varnish has been cleaned in this way, it should be tested for specific gravity with a hydrometer and solvent added to bring the specific gravity to that recommended for the varnish.


INDIVIDUAL VENTILATING PIPES LEADING FROM TOP OF OVEN
MAIN VENTILATING PIPE CONNECTED TO BLOWER OR THROUGH
DAMPERS
RECORDING THERMOMETER
DEEP WELL
REAR DOOR WHEN USED
COILS, FLOOR OF OVEN
REST OF STEAM COILS
OVEN DOOR
AIR INLET DAMPERS
PIT FOR STEAM COIL CONNECTIONS, VALVES, ETC. EXTENSION OF OVEN PIT
FRESH AIR DISTRIBUTORS
WALL FOUNDATIONS

This diagrammatic arrangement shows the essential heating and ventilating arrangements of an oven in which windings are baked after dipping in insulating material

It will sometimes be found that varnish after the proper solvent is added and the specific gravity brought to the recommended value, that this varnish will tend to run,

NAME AND DESCRIPTION OF PIECES TO BE TREATED.	BAKING TEMPERATURES IN DEGREES C.	NAME OF VARNISH USED.							
		EXTRA INSULATING	N.E. No 15 OR B.C. No 1.	EXTRA ELASTIC.	BLACK QUICK BAKING.	ELASTIC BLACK BAKING.	BLACK PLASTIC INSULATOR.	COPAL OR DOPALAC	ARMATURE LACQUERS.
PAPER, CAMBRIC, COTTON TAPE AND SURFACE WORK, SMALL MACH.	100	10	4	16	8	14	18	½	1
	125	6	2	10	5	9	12	—	—
UNIT ARMATURE COILS, LIGHT. FIELD COILS, SECTION BELOW 1 SQ.IN. IGNITION COILS, SURFACE PROTECTION	100	10	5	16	8	14	18	½	1
	115	8	4	13	6	12	15	—	½
	135	6	3	10	5	10	12	—	—
UNIT ARMATURE COILS, HEAVY. FIELD COILS, SECTION BELOW 2 SQ.IN. TRANSFORMER COILS, AIR COOLED	100	14	7	20	11	18	22	1	3
	115	11	6	16	9	15	19	—	2
	135	9	4	13	7	12	15	—	—
UNIT ARMATURE COILS, VERY LARGE FIELD COILS, SECTION BELOW 4 SQ.IN. IGNITION COILS, MAGNETOS, INTERIOR	100	16	8	22	13	20	24	4	4
	115	14	7	18	10	17	21	—	—
	135	12	6	15	8	14	18	—	—
FIELD COILS, SECTION ABOVE 4 SQ.IN. TRANSFORMER COILS, OIL COOLED. HEAVY MAGNET COILS.	100	20	10	24	16	22	28	—	—
	115	18	9	20	13	19	24	—	—
	135	16	8	17	10	16	21	—	—
SMALL AC OR DC STATORS, COMPLETE. COMPLETE ARMATURES UP TO 4" DIA. HEAVY, AIR COOLED TRANSFORMER COILS	100	16	8	22	14	22	28	—	—
	115	12	6	18	11	19	24	—	—
	135	9	5	15	9	16	21	—	—
MEDIUM AC OR DC STATORS, COMPLETE. COMPLETE ARMATURES 4" TO 8" DIA. HEAVY, OIL COOLED TRANSFORMER COILS	100	20	10	24	16	24	30	—	—
	115	18	9	20	13	21	26	—	—
	135	16	8	17	10	18	24	—	—
HEAVY AC OR DC STATORS, COMPLETE. COMPLETE ARMATURES 8" TO 16" DIA. SMALL ARMATURES WITHOUT BANDS.	100	24	14	28	20	30	36	—	—
	115	22	12	24	17	26	32	—	—
	135	20	10	21	14	22	28	—	—
VERY HEAVY MAGNET COILS. VERY HEAVY AC. OR DC. STATORS. COMPLETE ARMATURES 16" TO 30" DIA.	100	30	18	32	26	36	42	—	—
	115	28	16	29	23	32	36	—	—
	135	26	14	26	20	28	34	—	—
COMPLETE ARMATURES ABOVE 30" DIA. COMPLETE TRANSFORMERS, MEDIUM. PARTS WHERE VERY THOROUGH BAKING IS ABSOLUTELY ESSENTIAL TO ENSURE BINDING CONDUCTORS ETC.	100	36	24	40	32	42	48	—	—
	115	34	20	36	29	38	44	—	—
	135	32	18	32	26	34	40	—	—

A very useful table showing the baking time in hours and at different temperatures for one type of varnish. Tables like this can be made for any type of material

have less filling ability than previously and require a longer baking period than originally recommended. In such a case this condition is usually due to the type of thinner that is used. The lighter elements of the varnish have slowly evaporated leaving the heavier ones. The varnish at the specified gravity will then contain less base and a heavier thinner. It will be possible to make use of this varnish but the best procedure is to send a sample of it to the manufacturer and ask for a recommendation on the method to use in the applying of this varnish. This will be of advantage only in case a large quantity of varnish in the condition named is on hand. If the quantity is small, it should be thrown away and new varnish used.

Draining of Coils and Stators.—When coils or completed stators are heated and then dipped in insulating varnish, it is advisable to leave the parts in the insulating varnish until all air bubbles cease to rise to the surface and until the bath of insulating varnish has cooled. In those cases where coils are of large cross section, or where a large number of turns of fine wire has been used, the penetration of the varnish will be slow and the leaving of the parts in the insulation varnish for a longer time than required for the varnish to cool will have good effect. When removing coils and complete stators from varnish, this should be done slowly and at such a rate as will enable the varnish to flow slowly from the coils by gravity and leave a uniform covering of insulation. The quicker the dip and the faster the rate of withdrawal, the heavier the outside coat will be, but the penetration will be less. The time required for draining will depend upon the size of the coil or the stator and the nature of the varnish used. In any case, the draining should be for a sufficient period to allow all the dripping to cease and the varnish to take a partial set. After draining is completed the dipped coils or stators should be placed in a suitable oven and baked for the period recommended for the particular varnish used as outlined in previous articles dealing with this subject. When coils or completed stators are placed in an oven, the position should be such that the top of the part during draining is at the bottom during baking. When heat is applied, the first effect is to tend to cause the varnish to flow. By reversing the position of the dipped part as mentioned, the heavier accumulation of varnish during the draining period tends to soften and flow toward the lower end and thus give a uniform covering while baking.

Baking Ovens.—Too often, crude home made ovens are used in baking coils and completed stators in which it is

DEGREES F	SPECIFIC GRAVITIES.															DEGREES C
32	.830	.829	.830	.835	.840	.845	.850	.855	.860	.865	.870	.875	.880	.885	.890	0.0
34	.819	.824	.829	.834	.839	.844	.849	.854	.859	.864	.869	.874	.879	.884	.889	1.1
36	.819	.824	.829	.834	.839	.844	.849	.854	.859	.864	.869	.874	.879	.884	.889	2.2
38	.818	.823	.828	.833	.838	.843	.848	.853	.858	.863	.868	.873	.878	.883	.888	3.3
40	.817	.822	.827	.832	.837	.842	.847	.852	.857	.862	.867	.872	.877	.882	.887	4.4
42	.816	.821	.826	.831	.836	.841	.846	.851	.856	.861	.866	.871	.876	.881	.886	5.5
44	.815	.820	.825	.830	.835	.840	.845	.850	.855	.860	.865	.870	.875	.880	.885	6.6
46	.815	.820	.825	.830	.835	.840	.845	.850	.855	.860	.865	.870	.875	.880	.885	7.7
48	.814	.819	.824	.829	.834	.839	.844	.849	.854	.859	.864	.869	.874	.879	.884	8.8
50	.813	.818	.823	.828	.833	.838	.843	.848	.853	.858	.863	.868	.873	.878	.883	10.0
52	.812	.817	.822	.827	.832	.837	.842	.847	.852	.857	.862	.867	.872	.877	.882	11.1
54	.811	.816	.821	.826	.831	.836	.841	.846	.851	.856	.861	.866	.871	.876	.881	12.2
56	.811	.816	.821	.826	.831	.836	.841	.846	.851	.856	.861	.866	.871	.876	.881	13.3
58	.810	.815	.820	.825	.830	.835	.840	.845	.850	.855	.860	.865	.870	.875	.880	14.4
60	.809	.814	.819	.824	.829	.834	.839	.844	.849	.854	.859	.864	.869	.874	.879	15.5
62	.808	.813	.818	.823	.828	.833	.838	.843	.848	.853	.858	.863	.868	.873	.878	16.6
64	.807	.812	.817	.822	.827	.832	.837	.842	.847	.852	.857	.862	.867	.872	.877	17.7
66	.807	.812	.817	.822	.827	.832	.837	.842	.847	.852	.857	.862	.867	.872	.877	18.8
68	.806	.811	.816	.821	.826	.831	.836	.841	.846	.851	.856	.861	.866	.871	.876	20.0
70	.805	.810	.815	.820	.825	.830	.835	.840	.845	.850	.855	.860	.865	.870	.875	21.1
72	.804	.809	.814	.819	.824	.829	.834	.839	.844	.849	.854	.859	.864	.869	.874	22.2
74	.803	.808	.813	.818	.823	.828	.833	.838	.843	.848	.853	.858	.863	.868	.873	23.3
76	.803	.808	.813	.818	.823	.828	.833	.838	.843	.848	.853	.858	.863	.868	.873	24.4
78	.802	.807	.812	.817	.822	.827	.832	.837	.842	.847	.852	.857	.862	.867	.872	25.5
80	.801	.806	.811	.816	.821	.826	.831	.836	.841	.846	.851	.856	.861	.866	.871	26.6
82	.800	.805	.810	.815	.820	.825	.830	.835	.840	.845	.850	.855	.860	.865	.870	27.7
84	.799	.804	.809	.814	.819	.824	.829	.834	.839	.844	.849	.854	.859	.864	.869	28.8
86	.799	.804	.809	.814	.819	.824	.829	.834	.839	.844	.849	.854	.859	.864	.869	30.0
88	.798	.803	.808	.813	.818	.823	.828	.833	.838	.843	.848	.853	.858	.863	.868	31.1
90	.797	.802	.807	.812	.817	.822	.827	.832	.837	.842	.847	.852	.857	.862	.867	32.2
92	.796	.801	.806	.811	.816	.821	.826	.831	.836	.841	.846	.851	.856	.861	.866	33.3
94	.795	.800	.805	.810	.815	.820	.825	.830	.835	.840	.845	.850	.855	.860	.865	34.4
96	.795	.800	.805	.810	.815	.820	.825	.830	.835	.840	.845	.850	.855	.860	.865	35.5
98	.794	.799	.804	.809	.814	.819	.824	.829	.834	.839	.844	.849	.854	.859	.864	36.6
100	.793	.798	.803	.808	.813	.818	.823	.828	.833	.838	.843	.848	.853	.858	.863	37.7
102	.792	.797	.802	.807	.812	.817	.822	.827	.832	.837	.842	.847	.852	.857	.862	38.8
104	.791	.796	.801	.806	.811	.816	.821	.826	.831	.836	.841	.846	.851	.856	.861	40.0
106	.791	.796	.801	.806	.811	.816	.821	.826	.831	.836	.841	.846	.851	.856	.861	41.1
108	.790	.795	.800	.805	.810	.815	.820	.825	.830	.835	.840	.845	.850	.855	.860	42.2
110	.789	.794	.799	.804	.809	.814	.819	.824	.829	.834	.839	.844	.849	.854	.859	43.3
112	.788	.793	.798	.803	.808	.813	.818	.823	.828	.833	.838	.843	.848	.853	.858	44.4
114	.787	.792	.797	.802	.807	.812	.817	.822	.827	.832	.837	.842	.847	.852	.857	45.5
116	.787	.792	.797	.802	.807	.812	.817	.822	.827	.832	.837	.842	.847	.852	.857	46.6
118	.786	.791	.796	.801	.806	.811	.816	.821	.826	.831	.836	.841	.846	.851	.856	47.7
120	.785	.790	.795	.800	.805	.810	.815	.820	.825	.830	.835	.840	.845	.850	.855	48.8
122	.784	.789	.794	.799	.804	.809	.814	.819	.824	.829	.834	.839	.844	.849	.854	50.0
124	.783	.788	.793	.798	.803	.808	.813	.818	.823	.828	.833	.838	.843	.848	.853	51.1
126	.783	.788	.793	.798	.803	.808	.813	.818	.823	.828	.833	.838	.843	.848	.853	52.2
128	.782	.787	.792	.797	.802	.807	.812	.817	.822	.827	.832	.837	.842	.847	.852	53.3
130	.781	.786	.791	.796	.801	.806	.811	.816	.821	.826	.831	.836	.841	.846	.851	54.4
132	.780	.785	.790	.795	.800	.805	.810	.815	.820	.825	.830	.835	.840	.845	.850	55.5
134	.779	.784	.789	.794	.799	.804	.809	.814	.819	.824	.829	.834	.839	.844	.849	56.6
136	.779	.784	.789	.794	.799	.804	.809	.814	.819	.824	.829	.834	.839	.844	.849	57.7
138	.778	.783	.788	.793	.798	.803	.808	.813	.818	.823	.828	.833	.838	.843	.848	58.8
140	.777	.782	.787	.792	.797	.802	.807	.812	.817	.822	.827	.832	.837	.842	.847	60.0
142	.776	.781	.786	.791	.796	.801	.806	.811	.816	.821	.826	.831	.836	.841	.846	61.1
144	.775	.780	.785	.790	.795	.800	.805	.810	.815	.820	.825	.830	.835	.840	.845	62.2
146	.775	.780	.785	.790	.795	.800	.805	.810	.815	.820	.825	.830	.835	.840	.845	63.3
148	.774	.779	.784	.789	.794	.799	.804	.809	.814	.819	.824	.829	.834	.839	.844	64.4

A table showing the specific gravities of an insulating varnish at different temperatures. Similar tables can be made for any varnish and will be found very useful in the shop

impossible to secure the temperature recommended for a particular varnish. An effective baking oven should be well heat insulated. It is advisable to build the walls double and fill the space between with insulating material which will prevent the passage of heat from the inner to the outer surface of the oven. Baking ovens are available in various sizes heated by gas, steam, oil or electricity. Whatever may be the heat generating medium, it is important that the temperature throughout the oven should be uniform. The temperature at the top of the oven should be the same as the temperature at the bottom. Even though the construction of the oven may be such as to provide these features of low heat loss through the sides and uniform temperature within the oven, proper drying of the varnish cannot be obtained if the parts being heated are simply stewed in the vapor of their own solvent. There must, therefore, be some method of removing these vapors and in large ovens, it is advisable to install a slow speed fan to prevent the formation of cold pockets, to keep the air in motion and to remove the vapors generated during the baking process. This requires a chimney or stack connected to the oven provided with a damper. When the solvent vapors are not being carried away rapidly enough at the proper baking temperature, this will be evident by a cloud of black smoke coming out of the oven when the doors are opened.

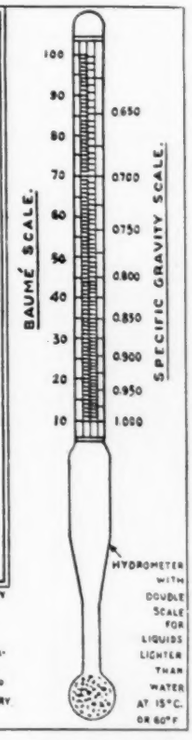
Another important feature in connection with oven construction is an arrangement for supplying the required amount of fresh clean air. Too much fresh air is better than too little. While too much fresh air will waste the heat, it will at least assure satisfactory drying of the varnish. Fresh air to the oven should be brought in so that it strikes the heating units first without lowering the temperature of the oven. In small ovens holes cut in the outside walls and provided with adjustable slides will usually be sufficient. In larger ovens a small blower used to drive off the excess of vapor and draw fresh air into the oven is advisable.

DEGREES BAUMÉ	SPECIFIC GRAVITY	DEGREES BAUMÉ	SPECIFIC GRAVITY	DEGREES BAUMÉ	SPECIFIC GRAVITY
80	0.667	56	0.753	32	0.864
79	0.670	55	0.757	31	0.870
78	0.673	54	0.761	30	0.875
77	0.676	53	0.765	29	0.881
76	0.680	52	0.769	28	0.886
75	0.683	51	0.774	27	0.892
74	0.686	50	0.778	26	0.897
73	0.690	49	0.782	25	0.903
72	0.693	48	0.787	24	0.909
71	0.697	47	0.791	23	0.915
70	0.700	46	0.796	22	0.921
69	0.704	45	0.800	21	0.927
68	0.707	44	0.805	20	0.933
67	0.711	43	0.809	19	0.940
66	0.714	42	0.814	18	0.946
65	0.718	41	0.819	17	0.952
64	0.722	40	0.824	16	0.959
63	0.725	39	0.828	15	0.966
62	0.729	38	0.833	14	0.972
61	0.733	37	0.838	13	0.979
60	0.737	36	0.843	12	0.986
59	0.741	35	0.849	11	0.993
58	0.745	34	0.854	10	1.000
57	0.749	33	0.859		

TO CONVERT DEGREES BAUMÉ TO SPECIFIC GRAVITY. SP. GR. = $\frac{140}{130 + °B.}$

TO CONVERT SPECIFIC GRAVITY TO DEGREES BAUMÉ. °B. = $\frac{140}{SP. GR.} - 130$

ABOVE SCALES ARE AT THE STANDARD REFERENCE TEMPERATURE 15°C. (60°F.) ON WHICH COMMERCIAL RATINGS ARE BASED. TO FIND SPECIFIC GRAVITY AT OTHER TEMPERATURES; ADD 1° B. FOR EVERY 5°C. BELOW 15°C. OR SUBTRACT 1° B. FOR EVERY 5°C. ABOVE 15°C.



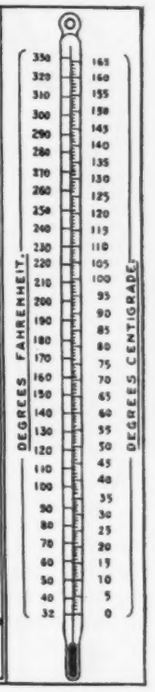
A table of Baumé and specific gravity scales for liquids lighter than water. This is used for checking varnishes and solvents used with them as insulating materials

When large parts that have been dipped in insulating varnish are put into a heated oven, the damper in the stack should be wide open to allow the removal of the vapor which is quickly generated. Later on when the solvent has been nearly driven off and the varnish is being oxidized, the damper in the stack may be partially closed. It is obvious that satisfactory operation from a baking oven cannot be obtained unless a suitable oven thermometer is used or a recording instrument.

CENT.	FAHR.	CENT.	FAHR.	CENT.	FAHR.	CENT.	FAHR.
200	392	119	246	79	174	39	102
190	374	118	244	78	172	38	100
185	365	117	243	77	171	37	99
180	356	116	241	76	169	36	97
175	347	115	239	75	167	35	95
170	338	114	237	74	165	34	93
165	329	113	235	73	163	33	91
160	320	112	234	72	162	32	90
155	311	111	232	71	160	31	88
150	302	110	230	70	158	30	86
149	300	109	228	69	156	29	84
148	298	108	226	68	154	28	82
147	297	107	225	67	153	27	81
146	295	106	223	66	151	26	79
145	293	105	221	65	149	25	77
144	291	104	219	64	147	24	75
143	289	103	217	63	145	23	73
142	288	102	216	62	144	22	72
141	286	101	214	61	142	21	70
140	284	100	212	60	140	20	68
139	282	99	210	59	138	19	66
138	280	98	208	58	136	18	64
137	279	97	207	57	135	17	63
136	277	96	205	56	133	16	61
135	275	95	203	55	131	15	59
134	273	94	201	54	129	14	57
133	271	93	199	53	127	13	55
132	270	92	198	52	126	12	54
131	268	91	196	51	124	11	52
130	266	90	194	50	122	10	50
129	264	89	192	49	120	9	48
128	262	88	190	48	118	8	46
127	261	87	189	47	117	7	45
126	259	86	187	46	115	6	43
125	257	85	185	45	113	5	41
124	255	84	183	44	111	4	39
123	253	83	181	43	109	3	37
122	252	82	180	42	108	2	36
121	250	81	178	41	106	1	34
120	248	80	176	40	104	0	32

TO CONVERT DEGREES C. TO DEGREES F.; $°F = \frac{9C°}{5} + 32$.

TO CONVERT DEGREES F TO DEGREES C.; $°C = \frac{5(F°-32)}{9}$



A table showing comparisons between Fahrenheit and Centigrade scales which will be found very useful in mixing insulating varnishes and other compounds

The usual range of temperature for baking insulating varnish is from 212 deg. Fahr. to 275 deg. Fahr. The higher the temperature the quicker the drying of the varnish on the outside surface of coils. The lower temperature is advisable for the reason that the varnish will be dried all the way through without the formation of a skin over the outside, which will tend to hold the varnish in liquid or semi-liquid state in the slot sections. During the latter period of baking, the temperature can be increased around 220 deg. Fahr. from a slow baking temperature of 212 degrees for satisfactory baking.

Brush and Spray Treatment.—When the dipping of coils is impossible or when a finishing coat only is required, this finishing coat can be applied by brush or an air gun. When a brush is used, it is important to go over the surface insulated with the varnish to make sure that the coat applied is uniform and prevent accumulations of varnish at spots. When two heavy coats are applied by a brush and clear varnish is used, care must be taken that parts of the winding are not overlooked and to avoid this the work must be done in a uniform light where no shadows are cast.

The spraying of varnish by the use of an air gun is preferable to brushing, for the reason that the varnish can be applied more evenly and forced into all openings of the winding. A spray gun that holds about a quart of varnish is a suitable size. The usual types of spray guns require about five cu. ft. of air per minute at a pressure of between 5 to 80 lbs. per square inch, depending upon

(*Continued on page* 314)

How One Big Corporation *Trains* New Salesmen

For one year Westinghouse sales students are trained widely in commercial shop practice. Six months to a year is spent in sales offices

By Roger L. Knight
Associate Editor, Electrical Manufacturing

No two salesmen are trained alike, but there are certain typical methods that are sufficiently defined that they can be correctly called fundamental. It would be ideal to train each individual salesman as an individual, but practical considerations make this impossible in large corporations. Thus certain systems of training must be laid down as general guides to be followed by all but exceptional sales students. One such system of training is used by the Westinghouse Electric & Manufacturing Company. This course for new salesmen is highly organized and most carefully operated. It is designed carefully to direct the activities of the student and to estimate his worth from the time he leaves college until he is in the field actually meeting customers. Although sales training is given to a few students who are not technically trained, the majority of salesmen are enlisted from the technical colleges, and this discussion must be limited to the training given to technical graduates.

Selection is the first problem in building a sales force. There are about seventy colleges and universities throughout the country from which this company makes an especial effort to enlist students for the sales course. Approximately a thousand applications for this course are received every year, from which about one hundred are finally accepted. Most of these come from a special list of about fifteen colleges known as scout schools. Some time during the year there is sent to each of these schools a student, usually one who was graduated from this school the previous year. This student, known as a scout, describes to the senior electrical and mechanical classes the purposes and methods of the company's student course, and makes with each student an appointment with a member of the company's Educational Department, who follows the scout by three or four days. The scout's functions are to describe the course, answer any questions regarding it, and to make a detailed report on each student in the graduating class. This report includes the plans of the student after graduation, his personal qualifications, and in general whether or not he is a desirable prospect and whether or not he will likely be available. Largely on the basis of the scout's report, the representative of the educational department makes an effort to induce the most promising students to make application for the student course.

Much of the test work on all types of apparatus is done by graduate students as a part of their regular study. Test work of various kinds is given during the first year

In recognition of the fact that engineering graduates have almost no understanding of the business of engineering, the first task of training the new technical salesman is to lure him away from the academic point of view and into the commercial point of view. A year is spent in doing this. For the first month the student is given an opportunity to orient himself to conditions which are in most cases, entirely strange to him. First, he is put into some section of the shop on some minor detail of shop work. He is not expected to pay his way, but he is expected to observe widely and carefully. He is given an opportunity to become thoroughly acquainted with the physical features of the shop, and with the methods of the shop. After a week or more of orientation, the student is expected to begin observing more closely the methods of manufacture. At this period of his development he is required to attend two two-hour classes each week for the purpose of studying the company's apparatus. These classes are conducted by headquarters salesmen. The student is provided with a

The above view shows graduate students engaged in commercial tests on small motors in the laboratory at Springfield. By this training the student gains first hand acquaintance with performance specifications of his company's products

set of questions for each class beforehand, and advertising and confidential literature to aid him in finding the answers to the questions. These questions cover points that have come up in salesmen's experience, and thus promote in a practical way the commercial point of view.

At the end of the first month the student is required to indicate the type of apparatus he wishes to study in particular. Although the course is general in nature, there is some specialization. After this month of orientation, the student must, for example, decide whether he wishes to pursue especially the study of distribution apparatus, or generating apparatus, or switchgear apparatus, or some other class of apparatus sufficiently defined that it can be grouped in this way. Having made this choice, the student is given a definite schedule for the remainder of the year, this schedule varying according to the student's specialty.

Training in Production Costs

USUALLY the new student is unaccustomed to thinking of electrical apparatus in terms of production costs. Rather has he thought of ideal designs with little consideration for cost. Thus, in training the new salesman, or better called sales engineer, it is necessary to make him conscious of the compromise that must constantly be made between the ideal machine and the machine that is commercially feasible. The most important step in accomplishing this is thoroughly to acquaint the student with production methods. The larger part of the first year with the company is spent in the various shops.

Here the student learns how the shop works, what its limitations are from a commercial point of view, and in general how the shop fits into the manufacturing picture. Here he learns how manufacturing schedules are kept, and how they affect delivery dates. In the shop he learns the meaning of time study and the significance of quantity production. He learns the desirability of standardizing wherever possible. He learns the meaning of inventory control and its dependence on accurate estimates of sales by men in the field. He sees the methods of adjusting the shop to new designs and to new production machines, and observes the necessity of estimating the number of machines of a new design that are to be made in order to determine whether or not the cost of adjusting the shop to them is justified. He observes the great amount of clerical work that is necessary to cordinate the specialized functions of quantity production, and thus is brought to understand the factors that combine to set the price of products. He learns of compromises that must be made to conform to patent conditions. He is taught the necessity and cost of safety measures, of insurance, of medical service, and of social services, the cost of which must finally be included in the price of products. He is taught the meaning of overhead costs and their relation to production schedules. He observes how the personal equation of workmen affects the operation of the shop and the quality of products, especially as these individual differences between workmen result in variations between products which are theoretically identical.

Providing Ammunition to New Salesmen

BESIDES this extensive commercialization function of the shop course, there is another intensive function, which consists of providing the embryo salesman with that which is popularly known as ammunition. Throughout these months which the student spends in the shop, he is directed to learn as much as possible about the various products manufactured by the company, the material out of which they are made, their design, the workmanship incorporated into them, their correct application, and their performance. From one to three months of the first year is spent on the various test floors. To gain this broad knowledge of products, the student is transferred from section to section frequently, and from one plant to another.

This frequent shifting of the student from one place to another of course detracts from his productiveness, but, as has been mentioned, the company does not try to make sales students pay their own way. The new sales student is looked upon as a long-time investment. It is estimated that the student must stay with the company at least two years after leaving the graduate course before he has paid back to the company in value of service the amount of money that was invested in him during the course.

Sometime during the first year the student is required to attend a two-weeks sales school. The purpose of this school is not only to promote the commercial point of view, but also to acquaint the student more thoroughly with the Westinghouse organization. Sales school consists of a series of lectures, about sixty in number, given by various department heads and field sales supervisors. These lec-

Sales students are extended many social and educational opportunities by the Westinghouse Club. A typical fraternal gathering is shown in the library of the club

tures are general in nature, and are intended to describe only in a general way the purpose and methods of the various departments of the company. After the student has attended the sales school, he finds that he thinks of the departments of the company in terms of personalities instead of in terms of squares on an organization chart. The student is given a clearer conception of the meaning of industrial organization. Intimacy with key men in a large organization reveals to him the fact that both the method and success of individual departments of a company depend upon the personalities in these departments. Thus the student sees the importance of developing such personal qualities as initiative, dependability and thoroughness. The student is required to keep a notebook on the sales school, which he keeps according to his own ideas. Upon the basis of this notebook, which is carefully graded, and upon the accuracy and conviction of answering questions in the class room, the student is graded according to the quarter of the class in which he falls. This grade is instrumental in determining where to place the student in the organization after the student course, so that he will be satisfied and of the greatest value to the company.

Upon completion of the student course of one year, the new salesman is put into one of the sections of the headquarters sales office to begin a more intensive training in the methods of handling negotiations and orders. The student's shop course is now over. Immediately he is employed at handling negotiations, which require him to become thoroughly familiar with price forms, with the supply catalog, with numerous forms used in the routine of business, with key men in the sales, engineering and shop organizations, and with salesmen in district offices. The new salesman is now both a producer and a student. Details of his training are now in the hands of himself and his section leader. In this new capacity, he becomes thoroughly familiar with the men and methods of that part of the headquarters sales organization in which he has chosen to specialize. Also he becomes thoroughly familiar with the relations between the field and headquarters sales organizations and with the relations between the various other headquarters organizations and the sales department. Details of company policy come to his attention daily, and daily he is tutored in the art of diplomacy. Here he learns by experience the necessity of selling himself and his ideas to his own company.

The new salesman remains in this combined training and producing period from six months to a year. During this time he is being trained either as a district office salesman or a headquarters salesman. In either case, his training is essentially the same. The new salesman is sent to a district office when commercial need requires it. He is usually selected for district office service on the basis of an interview with district office sales managers.

In the district office, the new salesman's function becomes more specialized. He is initiated into the field as an office assistant to several salesmen in the field. He takes care of these salesmen's correspondence with headquarters, and with the details of negotiations. His training now consists of becoming thoroughly familiar with the organization, methods and policies of the district office sales department, and of cultivating the personal acquaintance of customers as opportunity permits. Usually about eighteen to twenty-four months elapse between the time the new salesman enters the student course and the time he is put into the field actually meeting customers.

Throughout the training course of the new salesman, he is given as much freedom as possible, and as much opportunity as possible to develop himself. The policy of freedom is maintained because of the conviction that initiative can be developed only under conditions of comparative freedom. The purpose of this training course varies widely from the purpose of a college course. Whereas the college strives mainly to teach the elements of many arts and sciences in a limited time, the industrial sales course strives to teach the practical necessities of doing business at a profit. To this end self reliance is of paramount importance, and the quality of self reliance must grow in an atmosphere of freedom. Few things are required of the sales student; his destiny is largely in his own hands. He is made to understand, however, that his worth will be measured largely by the way in which he works out his destiny.

Opportunities for General Development

MOST important among the opportunities for development offered the sales student by the company is a course of lectures known as Technical Sections, sponsored by the Westinghouse Club. These lectures are largely of a technical nature, and appeal as much to the engineer and designer as to the salesman. They are directed to all three. Engineering knowledge is the keynote of these lectures. Speakers are drawn from various departments of the company and from other companies, as well as from nearby colleges and universities. Among the annual series of lectures is included at least one symposium of a purely cultural nature, it being recognized that the highest type of salesman must be a man of culture.

To avoid the possibility of salesmen "getting into a rut," careful records are kept of the progress of each salesman after he leaves the student course. Each man is checked up periodically, and cases in which men are not progressing normally are investigated. Remedies are arrived at on the basis of individual cases.

Remuneration for the graduate course of a year is made only high enough to take care of the common needs of an unmarried man. The course is offered to prospective students as an opportunity to gain valuable training and experience to fit them for remunerative and responsible work with the company after the apprenticeship period.

Molded Insulation—Its Uses in the Electrical Industry

No. 9 of a Series of Articles on Common Materials

Molded insulation is being extensively used in electrical manufacturing for the reason that it is easily adaptable to many different purposes

By William Crawford Hirsch

MOLDED insulation is the name commonly used in the electrical industry to designate insulating parts molded either from certain compounds of synthetic or natural resins or from hydrocarbons, such as asphalt and pitch, suitable binders being used for either class of mixtures. While porcelain, rubber and glass possess good insulating qualities, and are in fact molded insulation, each of these materials is considered in a class by itself, the custom of the trade restricting the designation of molded insulation to the products made from the compounds referred to. Important considerations in the selection of molded insulation, aside from heat-resistance and dielectric strength, are mechanical strength and ability to withstand tension, compression, shearing action and vibration of the working parts to which the insulation may be attached, and in many uses resistance to the disintegrating influence of moisture, oil solvents, acids, etc. In recent years, moreover, appearance, if not decorative ornamentation, has come to be of paramount importance in the choice of molded insulation for many purposes.

In grouping the various classes of molded insulation on the market it is usual to separate hot-molded from cold-molded. All descriptions of molded insulation are made by molding in steel molds or dies under pressure, but some classes of material are subjected to considerable heat while under pressure in the dies, others being merely pressed and baked following removal from the dies.

Molded insulation material is usually thought of as consisting of a binder and a filler. These may be organic or inorganic, natural or synthetic. Shellac, for instance, is a natural organic binder; asphalt, a natural inorganic binder. The phenol-formaldehyde products make up the group of

Molded insulating materials are becoming quite generally used by the electrical manufacturer, as may be seen from the several different types of products shown in the above illustration. As is evident, the use of this material is almost unlimited, as it can be conveniently formed into almost any desired shape or form and at the same time it takes a high degree of finish

synthetic organic binders. Wood flour and vegetable fibers are organic fillers. Because of its high heat-resistance, asbestos leads the inorganic fillers in importance.

Unsurpassed in the interest that has attended developments in the field of molded insulation have been the phenol-formaldehyde condensation products. Within the last few years virtually a new basic industry has been created as the result of the work of research chemists who followed in the footsteps of Dr. H. L. Baekeland, pioneer worker in the commercial application of these synthetic resins. Like the steel industry, the producers of phenol-formaldehyde molding compounds confine themselves to primary production, leaving the conversion of their product into finished mechanical units to others who are equipped to specialize in this direction. Production of the molding resins and their compounding are chemical processes that call for close control. The actual molding of insulating parts calls for a thorough understanding of mechanical problems, especially of mold-design and its many intricacies. As a result of this division into chemical production and mechanical conversion, a large number of custom molders of insulating parts have become important factors in the industry. On the other hand, the producers of these molding materials are constantly keeping abreast of the molders' problems, cooperating with them in their solution and matching their untiring research in the chemical laboratory with equally

Here is shown a motor brush holder with the various metal pieces or inserts cast in place. This piece is made of bakelite and the process of casting the inserts integral simplifies its construction

energetic sales promotion and educational activities aimed at all classes of consumers. They maintain competent engineers to assist electrical manufacturers in adopting designs that will serve best the insulating job for which they are intended and yet permit of economical production by the molder. Recognizing that shortcomings in molded insulation will be charged fully as much to the molding material as to the molder, leading producers of phenol-formaldehyde resins make it a condition governing the sale of their compounds that they must be used as supplied and not altered by the admixture of other ingredients, and that they must be molded in conformity with best practice rules which have been fairly well standardized.

In a discussion of the raw materials for molded insulation, the translucent and semi-transparent forms of phenol-formaldehyde resins which are marketed in rod or other semi-finished descriptions for machining, as well as the laminated products that are impregnated with the phenol-formaldehyde resins, have no place. Both find wide use in the electrical industry, the latter, in connection with mechanical fiber constituting a class of insulating material by itself, but we are here concerned only with molded insulation.

Phenol-formaldehyde molding compounds are marketed in powder or granular form, some special requirements, such as in overflow or flash molds for intricate insulator designs being met by so-called molding sheets. These sheets, 14 x 14 in. or 18 x 40 in., ⅛ or 3/16 in. respectively in thickness, are used where maximum molding plasticity is required. Where this is not the case, the powder form is preferred because of its imparting slightly greater mechanical strength.

Fillers are selected with reference to the service required. Wood flour lends itself admirably to compression in molding, volume being reduced to between one-third and two-fifths of the original, without loss of weight. Allowance must be made in the molds for this compression. Where higher heat-resistance is called for in an insulating part, asbestos fiber is used as filler. The heat-resisting quality can be further enhanced by baking after molding. On the other hand, machining is somewhat more difficult in the case of asbestos filler molding materials than when wood flour is used. The compression factor of asbestos fillers varies according to the length of the fiber used, but averages 3.5 to 1. Asbestos is recommended as filler when insulation has to meet the proximity of water and, therefore, lends itself to outdoor service where exposure to rain must be taken into consideration.

Making Molded Products

REGARDING the process that transforms phenol and formaldehyde into synthetic resins, it may be said that a large number of patents cover sundry phases of production. Avoiding the use of chemical formulæ, the underlying principle may be summed up by saying that when carbolic acid and formaldehyde, latter being a wood alcohol derivative, are condensed in the presence of a catalyst, a liquid or viscous product results. In the second stage of the reaction this is transformed into an insoluble and infusible mass by heating it at high temperatures in closed, jacketed kettles, steam furnishing the required pressure. The molded products made from these resins are unaffected by temperatures up to about 300 deg. Fahr. At about 600 deg. Fahr. they begin to char. Caustic alkalies will attack them, but aside from this they are unaffected by most acids and virtually hygroscopic. Standard colors are black and brown, but there are several shades of the latter and other colors are obtainable, such as red, terra cotta, green, gray, orange, mahogany, walnut, etc., while special colors can be produced to order and blending of colors is also possible in the hands of competent molders.

Aside from the demands made upon the die-maker's skill in the making of the hardened steel dies used in the molding of these resins, the molding operation is relatively simple. The dies are filled with a carefully regulated quantity of the resinous compound. Hydraulic pressure, ranging from 1500 to 3000 lbs. per sq. in., depending upon the character of the insulating part, is applied and steam at 125 lbs. pressure circulated in the upper and lower die members, thus supplying a temperature of about 350 deg. Fahr. necessary to fuse the compound into a mass that takes the shape of the die. Under full hydraulic pressure final hardening is obtained. Water-cooling permits of the removal of the molded insulation from the die. With properly designed dies and care in molding, tolerances of .005 in. plus or minus can be observed without too much of a burden on the molder. In fact, precision within a limit of .002 in. is obtainable, but where such accuracy is demanded in the specifications, it is to be expected that the piece cost will be increased because of the extra care required.

Size, shape and quantity of the insulating part to be molded determine the type of press used. Semi-automatic presses, permitting the molds to be clamped rigidly in place, so that the operator does not need to handle them, predominate, but there are other types, so-called molding-machines of the cam and gear type, used for the molding of small pieces.

The principal classes of dies used in molding phenol-formaldehyde resin compounds are overflow and positive molds. The former is made so that the upper and lower portions rest one on the other as they are brought together under pressure. In the positive mold the top plunger telescopes within the lower portion of the mold. In the overflow the molding compound or a pre-formed biscuit may be worked, provision being made for the excess material or flash being squeezed out as the die-members contact. In the positive mold, having no provision for overflow, the mold charge must be carefully apportioned.

Metal inserts can be securely imbedded during the molding operation, thus doing away with subsequent assembling operations. Lettering can be provided for in the mold by engraving or sinking, producing relief lettering on the insulating part.

Cold-Molded Insulation

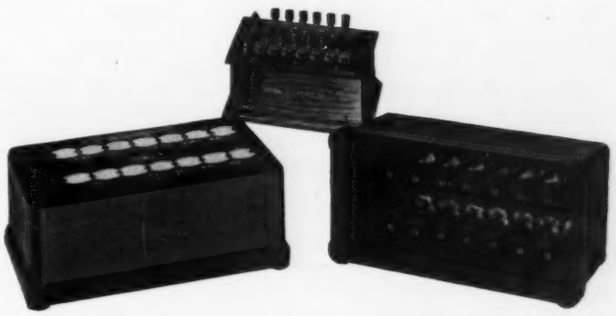
COLD-MOLDED organic insulation, better known as cold-molded composition, has built up for itself and continues to enjoy a wide field of usefulness, largely because of the economy in production costs involved in this class of molded insulation. It was to meet the need for moderately priced insulating materials of good mechanical and electrical strength that these more simple compounds entailing also a less complicated molding process were first put upon the market, and they have steadily expanded their field in the last twenty years. Binders are made from oil derivatives, pitches, etc., while asbestos, magnesia or kindred minerals serve as fillers. The binders are reduced to a viscous state by the use of solvents and then mixed with the filler in mechanical mixers. The resulting molding mixture, which is closely controlled with reference to its plasticity, is poured into cold molds that are subjected to a pressure ranging from 500 to 140,000 lbs. per sq. in., depending on the size of the piece being molded. The molding operation proceeds speedily, single cavity dies being generally used. Molding, which is carried out at room temperature, is followed by baking during which the volatile constituents of the bitumens are carried off and the solids further fused. Manufacturers of cold-molded insulation have learned to take care of the slight shrinkage which their product undergoes, as it comes from the molds, by making proper allowance for it in mold designs, and they are able to comply with quite rigid specifications. The finished insulation is either jet black or mahogany brown, and may be further finished by tumbling and polishing. One advantage of cold-molding over the hot process is that production is much more rapid and that size of the piece to be molded offers no problems, be it large or small. On the other hand, some of the raw materials used tend to shorten the life of the dies, and their maintenance and replacement is an important cost factor. Cement or silicate of soda is used as binder in some types of cold-molded insulation, resulting in compositions designed to withstand very high temperatures, in some instances as high as 1800 deg. Fahr. High absorption of moisture and consequent lowering of dielectric strength are factors of limitation in these products which are chiefly used in resistance units not having to meet severe atmospheric conditions. Another type of cold-molded insulation makes use of a synthetic gum in alcohol or benzol solution as filler impregnation. Holes, projections, inserts, inscriptions, etc., are formed during the molding of these insulating materials by the cold process.

Shellac plays the leading role in the category of hot-molded organic compositions. It serves as a binder that can be easily molded in the most complicated dies under heat, shellac being fusible at 40 to 60 deg. C. Dammar gum, resin, asphalt and bituminous pitches are used in some compounds of this class of binders. Fillers used in parts for telephone and telegraph installations and for indoor insulation generally are cotton or other vegetable fibers, while for outdoor insulation asbestos and mica come in for use. Wood pulp, magnesia, lime and gypsum are also used as fillers in this class of molding mixtures, lamp black and other dye pigments being introduced as coloring agents. The heated compound is rolled into sheets which, cut into convenient size, are placed in heated open dies from which they are removed in the form of finished insulation after cooling.

Selection of the correct type of molded insulation for each application is a matter for the best judgment of the electrical manufacturer, but may be generally summed up as follows:

Where safety, reliability of service and durability must be combined with attractive appearance and where cost is not an important factor of limitation in the choice of materials, the phenol-formaldehyde type of insulation is indicated. Magneto distributor, collector and similar parts, solenoid cores and magnet spool, charging and contact plugs, special parts for meters and instruments, ornamental lighting fixture parts and wiring devices, radio receiving set parts, special parts for electric fans are a few of the applications of this type of molded insulation.

Cold-molded composition is used in applications that call for good heat-resistance and that must be tough enough for handling and yet attractive in appearance. Manufacturers of this type of insulation lay considerable stress on the price advantage of their products. Plugs for electric flatirons and heating devices are a good example of the uses to which this type of molded insulation lends itself.



Another interesting example of the use of bakelite in its molded form. Notice that all metal inserts were cast integral with the cabinet as contrasted with the older type, in which they are separate

Where appearance, finish and strength to withstand frequent handling must be combined, but where heat-resistance is a minor consideration and where low cost is an important factor, shellac compounds come in for consideration. Some of the outstanding uses of this type of molded insulation are in switch handles, bases and blocks; attachment plugs and parts, overhead line insulations, weatherproof sockets, and telephone and telegraph parts.

Where parts are subjected to high temperatures and continuous arcing, the cold-molded cement compounds are indicated. They come in for use in terminal bushings and contact parts used for electric flatirons and heating devices, in arc deflectors and separators of electric controllers, third rail insulators and resistance grids.

Standard methods of testing molded insulation have been developed by a committee of the American Society for Testing Materials.

As with most other raw materials and parts used by the electrical manufacturer, the buyer fares best by laying his cards on the table in his contact with producers of molding materials and of finished molded insulation. Only when the latter know what service is expected of a particular piece of insulating material, can they go intelligently about providing the electrical and mechanical properties that are essential, and do this at a reasonable price.

Station G-A-G-E, Editor Speaking

Stanley A. Dennis, Editor and Assistant to the President

New England's Place in the Sun

ELECTRICAL manufacturers who have kept in touch with the service rendered to American business by the Department of Commerce during the past seven years know that that service has steadily increased in value from year to year. Each year has been marked by an increasing number of contracts between business and the department and a steadily increasing confidence between both sides, to the advantage of everybody concerned. Repeatedly the department has initiated activities which have called for the cooperation of industry and commerce and time and again business has launched activities which have later required the assistance of the department.

A recent activity and one of importance to electrical manufacturing interests, as well as to others, is the industrial and commercial survey of New England. This survey was begun months ago and has been completed. Final reports are soon to be published. In its completed form the report will comprise three volumes, as follows: "The Industrial Structure of New England," "The Commercial Structure of New England," and "The Handbook of Market Data on New England."

Already two sections of the volume on the commercial structure of New England have been printed in advance. These sections are entitled: "The Retailer and the Consumer in New England" and "New England Manufactures in the Nation's Commerce." Close inspection of these advance printings reveals an amazing quantity of facts and figures on New England business. In a list of 111 leading industries in New England, each of which contributed over $3,000,000 to New England income in 1925, the electrical industry ranks third (cotton goods, first; boots and shoes, second) producing 5.20 per cent of the total New England income and 17 per cent of the total income of the electrical industry for the entire United States. These and other facts and figures which should be of importance and value to New England electrical manufacturers who realize that the present and the future welfare of their businesses require the most accurate kind of information on which to base production and sales policies and plans. Of course, the reports cover practically all lines of industry, but that should only add to their value, at least in the mind of the business executive who requires no one to convince him of the interdependence of all lines of industry and commerce.

Why Be an Ostrich?

BAD weather and style seem to have something in common, surprising as it may seem. A great American humorist once declared that he had heard thousands of people kick about bad weather but he had never known anyone to do anything about it. Somewhat the same sort of thing may be said about style in manufactured products. Troublesome though style may be, even to the electrical manufacturer, no one seems to be able to curb to any great extent its power in industry and commerce.

An adolescent editorial in *Nema News,* November, disagrees rather sharply with a statement by John Allen Murphy in his article, "Style Sells Electrical Goods," in the November issue of ELECTRICAL MANUFACTURING. The Nema editorialist then attempts a final Olympian fiat in the following words:

"The electrical manufacturer can and must chuck the style nuisance out of his business. Fundamentally it has no place in his products."

Although Mr. Murphy needs no defense against this rather beardless pronouncement, the editor of ELECTRICAL MANUFACTURING dares to offer a bit of rebuttal evidence, as follows:

Says E. R. Dibrell, executive vice-president of R. H. Macy & Co.: "Take the case of percolators. Only a few years ago a respectable plain, round aluminum percolator sold well and steadily. But one day a manufacturer put out a paneled design—same capacity, same workmanship, same material. What happened? The paneled percolator ran the round percolator off the map. Nobody would buy the round ones for love or money."

Says the Kelvinator Corporation: "Style is an important factor and although it has not yet reached its height in electrical refrigeration, it is a factor which is beginning to confront us in our business."

Says the Hurley Machine Company: "It is necessary for us to keep constantly in touch with the changing conditions in style. It is getting to be a more important factor each year even for an ordinary thing like an electric washing machine or ironing machine."

And the General Electric Company has a committee whose business it is to see that when motors, turbines, switchboards are installed in plants where public inspection is invited these products shall be made as attractive as possible.

Enough! It would seem that any manufacturer (or editorialist) who believes that style "fundamentally has no place in his products" is playing the ostrich, that merry little game, you know, of believing you are not seen by others when you stick your own head into the sand.

Check the Safe Pull on Motor Bearings

BEARING troubles in electric motors are not common occurrences, so that when they do appear in the form of overheating or excessive wear and belts, silent chains or the so-called texrope short center drives are used, the source of the trouble will usually be outside the motor. When a large motor is applied to a machine, it is as important to check the bearing surface and the allowable safe pull as it is to carefully determine the rating in horsepower for the motor required.

In the case of the texrope drive, which consists of a number of small rubber-covered endless V-belts running in V-shaped grooves in the driving and driven sheaves, the width of the face of these sheaves for a 25 horsepower 860 r.p.m. motor with a 4 to 1 speed ratio of drive may be as wide as 10 inches. With excessive tension on these ropes, an excessive pressure is put on the bearings so that the oil film between the motor shaft and the bearing surface will not be sufficient for good lubrication with heating, and undue wear will result. This applies also in the case of a silent chain drive when operated too tight and not properly designed for the drive, but such operation is not usually experienced with silent chains unless the wrong chain pitch is used and

sprocket and chain dimensions are somewhat inaccurate.

It is also possible to get from the makers of short center drives the total pull in pounds that the drive will exert when operated under its rated load. This can then be checked against the allowable bearing pull for a motor of a particular horsepower rating and speed as furnished by the motor manufacturer. It is always better to be safe than sorry in dealing with possible troubles of this nature and the observance of the suggestions made will greatly reduce service costs and complaints after a machine has been installed.

Electrical Way to Broaden the Usefulness of Mechanical Equipment

ELECTRICAL testing and electrical instruments bring to the mind of some mechanical engineers and designers visions of standardizing laboratories with many and varied sorts of delicate electrical equipment manipulated by studious individuals with a mathematical turn of mind. This is an unfortunate picture, for every man who builds, installs or operates machines, that are in any way dependent on electric service for power drive or control, should have a full and confident knowledge of how to use simple types of portable instruments and get accurate results from them. Furthermore, we know of no installation of electrical apparatus but that better operating results can be secured and a saving in installation and operating costs can be shown if an adequate set of electrical instruments is employed by any individual who has a normal amount of common sense and a little more than average instinct to want to know what is going on while an electric watthour meter somewhere is piling up a record on which a monthly bill for service is paid.

We do not hereby accuse all mechanical men of shyness toward electrical instruments and the use of them in testing operations. Certain electrically operated machines display evidence of much thought on the electrical application and whether or not this comes from an electrical specialist who is employed or from the mechanical engineering department matters little, for the main idea and the one we desire to emphasize is that there is no excuse for a misapplication of a piece of electrical apparatus on a machine or device even when the electrical element is the smallest part of the outfit. When such a misapplication does appear, it stands out like the proverbial sore thumb as a weakness in design, which is sure to bring some discredit to the otherwise good design that the mechanical parts may or do embody.

At the present time it is altogether too frequent an occurrence for the used of a device to be forced to grope around in the dark and do considerable experimenting on his own part before he can change a belt operated tool or other similar device for electrical operation. Such information as needed should be available at the time it is required and as easily found in the literature prepared by the manufacturer as any other information on the range of operation of the machine itself. It is frequently heard that the main reason for the lack of information on the electrical control, power requirements, speed limitations in terms of standard motor speeds and the like, is the danger of placing this information in the hands of the operator for fear of its misuse. Yet expensive machines are being shipped every day to far points where there is no assurance of a mechanical familiarity adequate to get from the machine everything in the way of service that might be secured. We therefore contend that if the same attitude be taken toward electrical applications and operation and a freer use made of essential electrical information in connection with the installation of mechanical devices and this information as resulting from factory tests, be made available in catalogs and bulletins on mechanical machines and devices that can and probably will at some time be electrically operated, there would be a resulting reduction in selling costs for these machines and a much larger measure of satisfaction to the user.

To bring about this more or less ideal situation requires a liberal use of electrical instruments in the securing of complete test data that will fit into the requirements of electrical service wherever a machine may be shipped. Believing that there is already some interest in this direction as evidenced by the growing sale of electrical instruments, we have arranged to present in early issues of ELECTRICAL MANUFACTURING a series of articles covering the entire range of the selection and use of electrical instruments for the different tests that can be made on electrical equipment. If while this series of articles is appearing any reader will request details on tests that may be overlooked, the editors will appreciate the opportunity to secure and present such information as may be required. The information in these articles will, however, be confined to tests that can be made with portable instruments easily available in order that the information may have wide application.

Our plea is for a more extensive dissemination of electrical information relating to the mechanics of machines in so far as electrical means can be employed. Radio manufacturers have done this, and the result has been that a new group of specialists and electrical-mechanics has been created whose youth and number cause them to be buyers and users of the product made for a longer period of human life than has heretofore been experienced in any other line of manufacturing, electrical or mechanical.

Wanted—A New Name for Three-way and Four-way Switches

THE terms three-way and four-way for the switches that allow a light to be controlled from two and three sources, respectively, when properly connected are misleading to many users of these switches. Many architests, builders and even some electrical men are somewhat confused as to what these terms mean and what the switches really accomplish. The natural assumption for the layman is that three-way and four-way switches allow control of a light from three and four sources, respectively. The name would indicate this if we assume that these terms have been picked as carefully as other electrical definitions with the view of making the name tell of the function of the device.

The manufacturers of these switches seem to be undecided among themselves as to what these switches should be called. Approximately half of them call these devices by their old names and the others call them three-point and four-point switches. Possibly this is a little more accurate than the terms in most common use by architects and builders, but there is still room for improvement. The terms three-point and four-point may describe the switch better but they tell no more about the use of the switch than did the terms three-way and four-way. To be perfectly accurate these switches are never more than two-way but they may have three or four points of connection.

The electrical industry is usually careful in the selection of definitions and names for its various products. The best information available is used to formulate such things and it is hardly a credit to the industry as a whole that this misnomer should exist any longer. A better name that will be acceptable to all manufacturers and users of these switches, one that will not only tell the construction of the switches but will in addition make clear the uses of them should be adopted.

Characteristics That Determine the *Selection* of MOTORS

No. 7 of a Series Discussing Motors of Different Types

The principles of design of multi-speed motors are not new but some of their applications are and the field for them is steadily increasing

BY THEODORE SCHOU
Consulting Engineer, Fairbanks, Morse & Co.

AND

C. P. ROBINSON
Synchronous Engineer Ideal Electric & Mfg. Co.

THE wide distribution of alternating current through the inter-connection of transmission lines has made it very desirable and quite advantageous to use induction motors for applications where the speed characteristic is not constant. Previous articles, No. 4, 5 and 6 of this series, discussed the characteristics of the widely applied constant speed induction motor. In what follows, the multi-speed induction motor will be discussed as to characteristics and application.

Figure 1 shows the construction of a typical multi-speed induction motor of the consequent pole or pole changing type

Direct current motors were for many years considered practically a necessity for varying speed drives. The multi-speed induction motors are breaking into this field, more and more, due to characteristics that are nearly at par with the constant speed induction motor. The principles involved in the design of these multi-speed motors are not new, but some of the applications are new, and the field is steadily increasing for this type of motor.

Multi-speed Motors: Under the heading of multi-speed motors, we will consider motors which have certain definite speeds, which are fixed and cannot be deviated from. The use of multi-speed motors in the past has mainly been limited by the control apparatus available. Recently there have been developments made by control manufacturers, particularly, the Union Electric Mfg. Company of Milwaukee, which make possible the use of these motors for two, three, and four speeds.

It is both feasible and possible to build such motors in many types of windings and speeds, but the control to take care of a large number of connection changes would be very expensive; probably prohibitive. It may be said, however, that the field for these motors is just in the first stage of development, as regards general purpose application, and later on, should the need for an increased number of speeds be realized, the control will undoubtedly be available.

The multi-speed motors referred to in this discussion are squirrel cage induction motors. The rotating part or the rotor is of standard squirrel cage design, identical with the rotors discussed in articles No. 4, 5 and 6 of this series. The stator is designed to provide the different speeds.

Multi-speed squirrel cage motors for general purpose applications are classified under two general types.

(1) *Separate Winding Type:* These machines have a separate and distinct stator winding for each speed. They are built in 2, 3 or 4 speeds.

(2) *Consequent Pole or Pole Changing Type Motors:* These machines have one stator winding for each two speeds. They are built in 2, 3 or 4 speeds. The two-speed motors having one stator winding, the 3 and 4 speed motors having two stator windings. In each case where two speeds are obtained from one stator winding, the result is obtained by reconnecting the winding.

It may also be mentioned that special motors, for particular applications, to obtain special speed combinations, are built, combining both types of windings, having 3, 4 and 5 speeds.

Multi-speed motors have been built with as high as 18 synchronous speeds. Other motors have been built, having special speed ratios, using 3 phase supply current for one winding and 2 phase supply current for another. However, this discussion will be limited to the ordinary types that may be easily adaptable to commercial applications.

Speeds Obtainable: With the separate winding type of motors, any combination of synchronous speeds can be obtained. For example, a 4 winding, 4 speed motor, 60 cycles, can be built for 1200, 900, 720, 600 r.p.m. or 3600, 1200, 600, 360 r.p.m.

With the consequent pole type, such is not the case. For example a 2 winding, 4 speed, 60 cycle motor would provide 1800, 1200, 900, 600, or 3600, 1200, 1800, 600 or 1200, 900, 600, 450 or 1200, 720, 600, 360 r.p.m. In this case, the first and third speed is obtained from one winding, the second and fourth speed from the other winding, or such speed combinations as 1800, 900, 720, 360, could be obtained by

grouping the first two speeds in one winding and the last two in the second winding.

Both the separate winding type and the consequent pole type of squirrel cage induction motors may be further classified, under the following headings:

(a) Constant Horse Power—Variable Torque.
(b) Constant Torque—Variable Horse Power.
(c) Variable Torque—Variable Horse Power.

Characteristics of the Three Types: A study of the characteristics under any one of these headings must be accompanied by its own particular application in order that the significance of the different types may be better understood. The section of this article immediately following

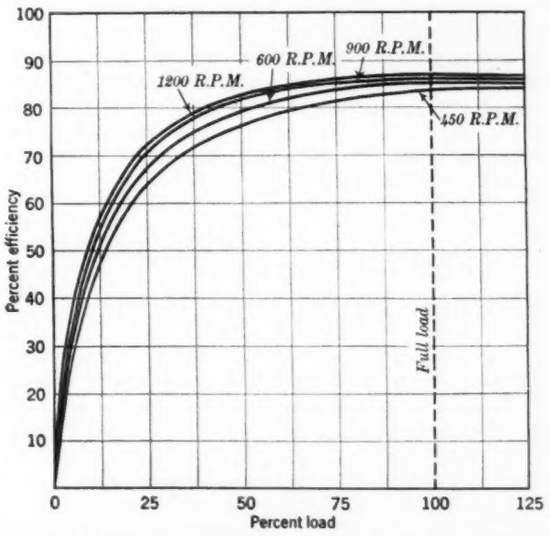


Figure 2 gives efficiency comparisons of a 75 hp. constant hp. rating multi-speed motor at four different operating speeds

will be devoted to an analysis of the characteristics of motors designed and built for a particular service. It should also be mentioned that the characteristics can be varied considerably by the designer. However, the data to be discussed will show the test results of motors that will clearly indicate what to expect in a given case.

(a) *Constant Horse Power Duty:* A 75 hp., 440 volt, 3 phase, 60 cycle multi-speed squirrel cage induction motor was built, designed to deliver its rated horsepower at four

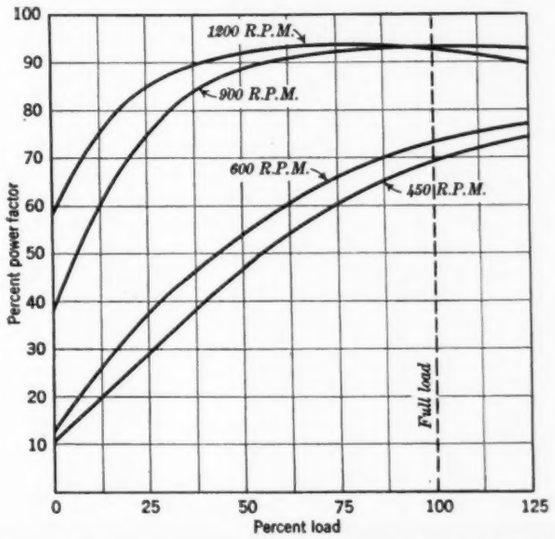


Figure 3 shows the power factor characteristics of the same motor as that shown in Figure 2. They compare very favorably with those of the standard constant speed induction motor

speeds, namely 1200, 900, 600, 450 r.p.m. This motor operates a draw bench for making seamless steel tubing. When the ingots are first started, the speed of drawing must be around 13 feet per minute. As the tube assumes

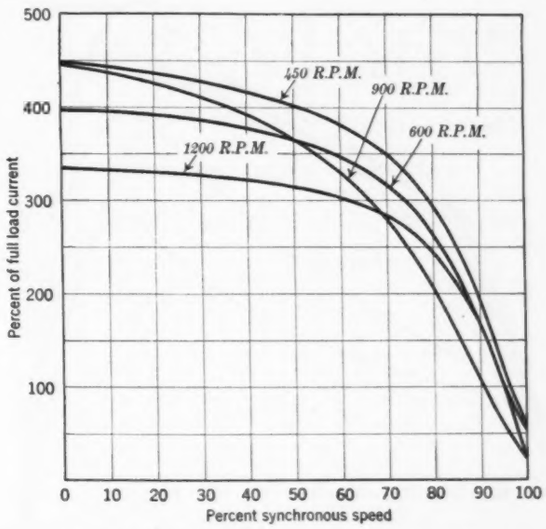


Figure 4 gives a comparison of the inrush current characteristics for the multi-speed motor. In general, the current characteristics are similar to those of the ordinary squirrel cage motor

shape, the speed of drawing can gradually be increased, so that by the time the tube is nearing completion, it can be drawn at about 36 feet per minute.

This motor is of the consequent pole or pole changing type and the stator consists of two windings, each winding reconnectable.

Figure 1 shows the type of frame construction used for this motor. Figure 2 gives an efficiency comparison at the four different speeds. Referring to the June issue of Electrical Manufacturing Figure 4 reveals the interesting fact that the efficiencies at all speeds, while not as good as those indicated for a standard line of squirrel cage induction motors, nevertheless, compare very favorably with the standard line. It is also to be noted that the efficiencies are consistently good for all four speeds. This is one reason why the multi-speed motor is preferable, over the variable speed or slip ring motor. The slip ring motor will be discussed later under the variable speed motors. It will be well for the reader to compare the characteristics of the multi-speed motors with the slip ring or variable speed motor. He may then draw his own conclusions as to the best type of motor for his own particular application, taking into account all the factors that ordinarily influence an installation, such as first cost, economy of operation, maintenance, reliability, performance, etc.

Figure 3 gives a power factor comparison for the four speeds. Referring to the September issue of Electrical Manufacturing Figure 1 gives the full load power factors for a standard line of single squirrel induction motors, it will be noted that the comparison is not unfavorable for the multi-speed motor.

The power factors do not compare as well with the standard motors as do the efficiencies. This fact, however, is probably not sufficiently disadvantageous to warrant the installation of equipment to furnish current for D.C. motor drive, where the multi-speed motor meets the service requirements.

The efficiency and power factor are the characteristics of a motor that determines its economy of operation. The fact that this motor retains good characteristics at all four speeds is very much in its favor. The fact that it retains the simplicity of the squirrel cage induction motor, without

slip rings or brushes, reflects low maintenance cost and reliability of operation.

Figure 4 gives a comparison of inrush currents for the various speeds. In general, the current characteristics for

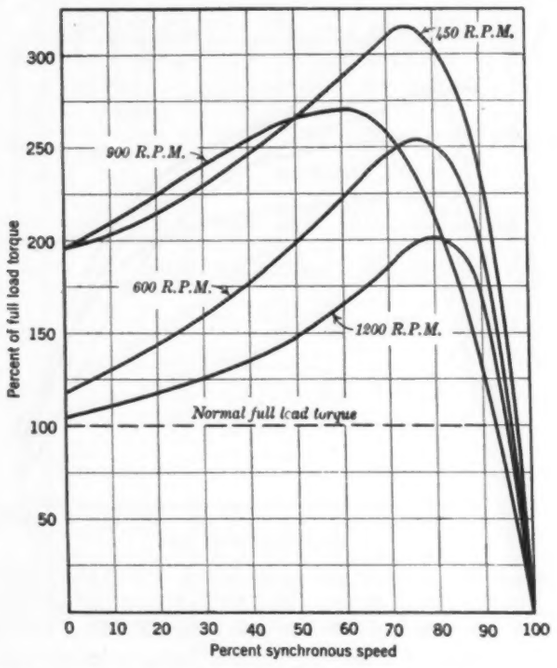


Figure 5. The starting characteristics of multi-speed motors compare very favorably with those of the standard squirrel cage motors. There is considerable variation in the maximum or pull-out torques, but, since, the torque is not less than 200 per cent at any speed it is sufficient for general purpose uses

this type of motor are quite similar to the ordinary standard single squirrel cage motor. It would be expected from an analysis of single squirrel cage motors that the inrush of this multi-speed motor would be higher at 1200 r.p.m. than at the other speeds. The fact that the reverse is true in this case is due to the difficulty of providing

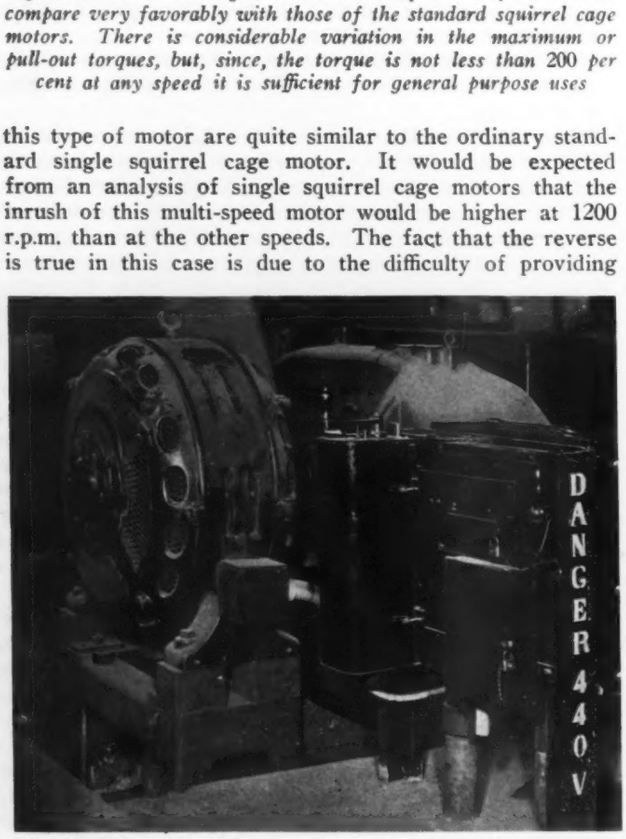


Figure 6 shows the 75 hp. multi-speed motor driving a draw bench for making seamless steel tubing. This motor may be used anywhere that constant hp. at varying speed is needed

a motor design which is balanced in characteristics at all speeds. Nevertheless the motors are quite commercial, and are performing successfully in a varied field of application.

Figure 5 gives a comparison of starting and maximum or pull-out torques for the different connections. It will be noticed that the starting torques compare favorably with standard motors at all speeds. While there is considerable variation in the maximum or pull-out torque, nevertheless the torque is not less than 200 per cent at any speed, which is sufficient for the average general purpose application. It is, however, quite possible to obtain higher pull-out torques where such are desirable, as is the case with peak load characteristics.

Figure 6 shows a picture of the 75 hp. driving the draw bench. While, we have mentioned, in particular one application, this type of motor may be applied to any service, where a constant horsepower multi-speed motor is required. other applications for which such a motor might be suitable are: Conveyors, stokers, some phases of rubber mill service, and any other operation where the process of manufacture is such that the work becomes easier to accomplish as the process advances, allowing the motor to be speeded up from one step to another, thus increasing production considerably over that of a constant speed motor, limited by the lowest speed of operation.

Measuring Exact Altitude of Airplanes by Radio Reflection

A METHOD of depth-sounding in the air to enable aviators to know their exact altitude with reference to mountain tops, trees and buildings and to make landings safely in fog, was suggested by Dr. E. F. W. Alexanderson, consulting engineer of the General Electric Company, in a paper presented at the autumn meeting of the National Academy of Sciences.

There is no instrument at present that measures absolute altitude above ground. The barometric altimeter is a great aid in aerial navigation, but it measures only relative altitudes and is altered by changing weather conditions.

In the course of his paper Doctor Alexanderson exhibited some graphic charts recorded by him during practical experimentation in the air. These charts conclusively proved the accuracy of his principle of detecting radio echoes as a means of measuring altitude up to 4000 ft.

In his experiments Doctor Alexanderson used an oscillating receiver, one of the type which sends out a wave which may be picked up by other receivers as a squealing note or beat. This squealing note is familiar to many radio listeners who have attempted to operate their receivers in the neighborhood of someone overworking a regenerative receiver. In Doctor Alexanderson's work the echo or signal reflected from the ground was picked up on the same receiver which sent out the wave. He discovered that every time the airplane changed altitude by half a wavelength, the whistling note went through a complete tone cycle, from a low pitch to a high pitch and back again to a low pitch. By counting the cycles of the tone it was possible to measure altitude, the measuring stick being one-half the wavelength of the antenna oscillator. In the first tests Doctor Alexanderson, blindfolded and using headphones, determined accurately the altitude up to 1600 ft. Graphic altitude logs were developed later, by means of which measurements were made up to 4000 ft.

"How this principle may be best applied for practical aerial navigation, we are not yet ready to say," stated Doctor Alexanderson. "Continuous graphic records may be used on larger craft, and it may thereby be possible to identify positively the course flown with the maps and previous experience. Such graphic altitude logs may also be used for surveying.

"A very desirable development will undoubtedly be an instrument which permits positive determination of altitude over the ground at any time desired."

Semi-Automatic Starters for Synchronous Motors

The semi-automatic starter for medium and high speed synchronous motors is designed for use where the cost of an automatic panel is not justified

By K. B. Spear

Industrial Control Engineering Department, General Electric Company

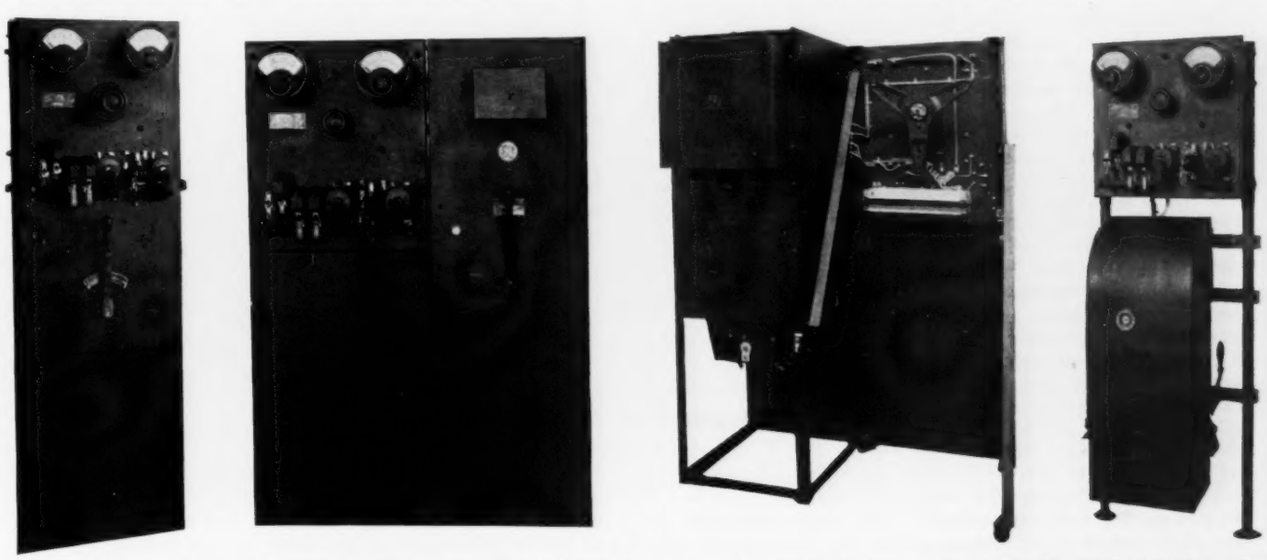
A SIGNIFICANT factor in the design of a synchronous motor starter is the similarity of the control to that of a squirrel-cage induction motor. This is especially true of medium and high-speed synchronous motors, in which the current and torque characteristics closely approximate those of induction motors. Both types of motors are started on reduced voltage, usually taking a starter of the compensator type. By the addition of suitable apparatus for applying field, an induction motor starter may be used with a synchronous motor of corresponding rating.

Previous to the introduction of push button control for synchronous motors, it was common practice to start these motors by means of a combination induction motor starter and manual field switch. However, this type of control does not conform to modern control standards, which stress positive and safe operation. Field must be applied only when motor has reached a suitable speed, and it must be applied at that time. Field excitation must be removed when the line switch is open. Failure to follow this procedure may seriously damage the motor, or at least result in unsatisfactory operation. Hence the desirability of automatic control of the field circuit for synchronous motors.

The semi-automatic starter for medium and high speed synchronous motors is designed for applications where an investment in a completely automatic starting panel may not be justified. This starter combines to good advantage, the manual features of induction motor starting and automatic control of the field circuit. The hand operated compensator which is part of this equipment is widely used for starting squirrel cage induction motors. Applying the compensators to the control of synchronous motors gives a starting procedure comparable to that of an induction motor, with which machine operators are familiar. The motor is accelerated through two movements of the starting handle, reducing the work to be done by the operator to a minimum. The starting handle must be thrown all the way to the "start" position before it can be moved to the "run" position. A definite stop at the start position is mandatory. The mechanism necessitates quick movements, eliminating the possibility of prolonged arcing of the switch contacts. Unless the final motion of the handle is definitely to the "run" position, it will automatically return to the "off" position.

The field switching is automatic. At the time the com-

(*Continued on page* 314)



Three different types of semi-automatic control switchboards are shown above. The one at the left is a semi-automatic starter for a switchboard line-up. That at the right is a view of a semi-automatic starter for low voltage, while the two views in the center show the front and back of a semi-automatic starter for high voltage. Notice the similarity of equipment and arrangements in each

What's NEMA Doing?

A department covering activities of the divisions, committees and sections of the National Electrical Manufacturers Association

Twelve Manufacturers Form Carbon Arc Lamp Section

A group of twelve manufacturers of carbon arc lamps has joined the National Electrical Manufacturers Association as a section, according to an announcement following approval of the board of governors at the recent fall meeting of Nema at Briarcliff Lodge, N. Y.

E. A. Williford

At an earlier meeting in Chicago, E. A. Williford, National Carbon Company, was elected temporary chairman. S. A. Moore, All-American Mohawk Company, was appointed temporary secretary.

The following companies are now members of the carbon arc lamp section of Nema: All-American Mohawk Company, Atlas Electric Devices Company, Automatic Arc Lamp Company, Britesun, Inc., Burdick Corporation, Interstate Electric Company, Paul E. Johnson, Inc., National Carbon Company, Inc., Photogenic Machine Company, Sanitarium Equipment Company, The Super-Power Arc Lamp Company, and M. J. Wohl & Company, Inc.

Radio Division Progresses with Service Course

The radio service course, which has been in the course of preparation under the direction of the radio division, was reported at the Briarcliff meetings to be in final manuscript form. A special committee is now engaged in reviewing the text to assure its technical accuracy and comprehensiveness. After the manuscript has been finally approved, only the mechanical production processes will remain before it is available for distribution by radio manufacturers to their dealers.

It is generally agreed that improving the character of service rendered by dealers to receiving set owners constitutes one of the important duties of the radio industry. Imperfect installations and incompetent service maintenance build up selling resistance, which affects the business of every manufacturer in the radio field. Consequently, this cooperative educational effort is considered a constructive move in meeting a major distribution problem which cannot be effectively and economically met by individual dealers themselves.

The text of the course itself is simply written, and is not prepared with the viewpoint of any single manufacturer or of any particular type of radio circuit. Dealers are called upon to service every kind and type of receiver, and the radio service course is written from that point of view. Manufacturers may subscribe for dealers upon a group basis, effecting a substantial reduction in cost per dealer.

Sign Receptacles Approved by Standards Committee

The standards of the lamp receptacles and socket section for immediate base sign receptacles and outside diameter of porcelain screw rings, which were approved by letter ballot, have been approved by the Standards Committee, Nema. The committee was advised that the lamp receptacle and socket section, due to new standards and certain changes in existing standards, is now also revising its standards on thickness of screw shells and distance from center contact to edge of insulation.

Prize Announced for Slogan on Industrial Electric Heat

The first joint committee of the National Electric Light Association and National Electrical Manufacturers Association representatives, appointed to discuss the development of the electric furnace business, met in Philadelphia on Oct. 11 and made considerable progress.

Each group agreed to contribute $250 toward a prize of $500 for the best slogan covering the industrial use of electric heat. The details of the contest were referred to a committee consisting of R. T. Kaighin, Public Service Electric & Gas Company, Newark, N. J., and Mr. Tall, Leeds & Northrup Company of Philadelphia.

It was unanimously agreed that the annual school for the training of utility salesmen in the sale of industrial electric heating applications should be a joint industry undertaking held at some centrally located university, such as the Case School of Applied Science in Cleveland.

Power Approvals Committee Includes Two Nema Men

H. E. Ruggles, Westinghouse Electric & Manufacturing Company, and Leon H. Frank, Bull Dog Electric Company, have been appointed Nema representatives on the Approvals Committee of the Hydro-Electric Power Commission of Ontario, on nomination by the panelboard and distribution board section, Nema.

Committee Named to Work Out S.E.D. Cooperation Plan

Following the meeting of the policies division, National Electrical Manufacturers Association, at Association Island, N. Y., a committee was appointed to work out a constructive plan in cooperation with other organizations when necessary for giving The Society for Electrical Development and local electrical leagues the whole-hearted support of the industry. The membership of the committee is:

W. E. Sprackling, chairman; Louis B. F. Raycroft, F. C. Hodkinson, G. A. Hughes, C. P. Berolzheimer, H. T. Bussmann, D. R. Bullen and S. L. Nicholson.

Another committee has been appointed to consider ways and means of carrying on a publicity campaign to educate the general public on the desirability of Underwriters' Laboratories approval for electrical products. The membership follows:

C. P. Berolzheimer, chairman; E. J. Schneider, I. A. Bennett, C. W. Abbott, A. W. Lundstrom, L. F. Adams, O. H. Van Amburg, F. T. Wheeler, R. H. Manson and H. J. Mauger.

Joint Committee to Consider Motor Breaker Protection

A joint committee, consisting of C. L. Kennedy, motor and generator section; F. T. Wheeler, knife and enclosed switch section; Frank Thornton, appliance division; W. C. Yates, industrial control section, and B. D. Horton, air circulator breaker section, has been appointed to consider the question of circuit breaker protection for small motors. C. L. Kennedy is chairman.

Since the motor and generator section has a greater interest in the subject than any other group, an additional representative, to be nominated by the chairman of that section, will be appointed on the joint committee.

L. F. Adams has been appointed Nema representative on the special committee of the sectional committee on scientific and engineering symbols and abbreviations, working on the preparation of graphical symbols for electric power, including interior wiring.

The Standards Committee has approved the action taken by the motor and generator section at its meeting June 14, covered by Items 2 to 26 inclusive, with the exception of Item 25 (e), which was referred to the technical committee of the motor and generator section for review.

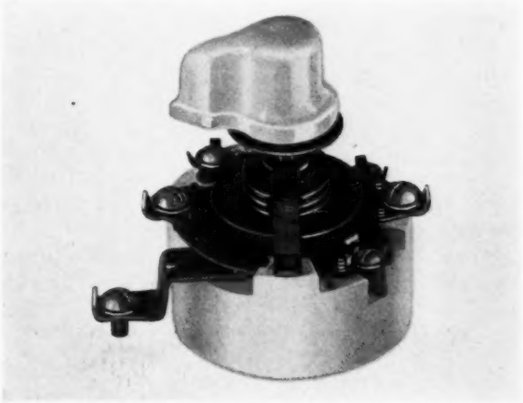
Heat Appliance Switches Differ from Other Types

The operating requirements of electric ranges necessitated a new design of switch and presented some interesting manufacturing problems

By Bertram A. Carstensen
Bryant Electric Company

WITH the advent of the electric cooking range the electric switch manufacturers were presented with the problem of furnishing a switching mechanism to regulate the degree of heat as furnished by the heating units of these ranges. The new operating conditions and requirements necessitated a newly designed switch which would meet these conditions and requirements satisfactorily. The method of obtaining the various degrees of heat by the interconnection of the heating units, or by the application of several voltages is familiar enough to all of us to be omitted from this article, which deals principally with the various problems presented to the electric switch manufacturer and the methods used to overcome these difficulties by the production of a suitable switch to withstand them.

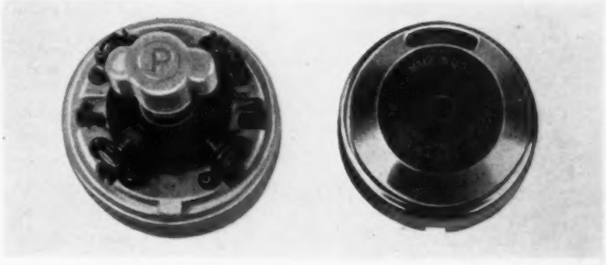
A switch installed in an electric range is subjected to operating conditions which are much more severe than those usually encountered by the ordinary electric light switch. It is not alone subjected to the heat produced internally by the arc at the breaking of the current but also to the external heat of the heating units of the stove. Since the



The illustration above shows one of the three-wire, balanced load designs of heater control switch through which the various degrees of heat are obtained by the use of several voltages and the interconnection of the heating units. This switch is for use without a cover in back panel-board work in electric ranges

electrical load is in many cases as high as three times that of the electric light switch and due to the external heat, the temperature of the switch obviously is comparatively high. For this reason the insulating barriers, discs and washers had to be made of some material which is non-inflammable or very nearly so. The insulating compounds also which ordinarily are of some wax or asphaltic composition of low melting point had to be replaced by other compounds to withstand the high operating temperatures. The insulating material to be used resulted in the adoption of specially impregnated fibres or bakelite treated cloths and papers.

Switches used on an electric range are operated perhaps three to four times more often than the ordinary electric light switch, as will readily be appreciated when we con-



This switch uses the rotary dial method of position indication and has various types of wire terminals to suit the individual requirements of the particular installation

sider the more extensive daily use of the electric stove than the electric light. The endurance of the electric range switch then had to be from three to four times as great as that of the electric light switch to give the corresponding life in years of service. To accomplish this called for a design of both electrical and mechanical perfection.

At the present time, due to its extreme accuracy in molding, heat resisting hot mold composition is finding favor as a material for the base of the range switch. In order to supplant the usual porcelain base, it will be necessary for further redesign to permit using a much smaller amount of bakelite than the usual quantity of porcelain used at present, if we are to put it on a competitive price level with porcelain.

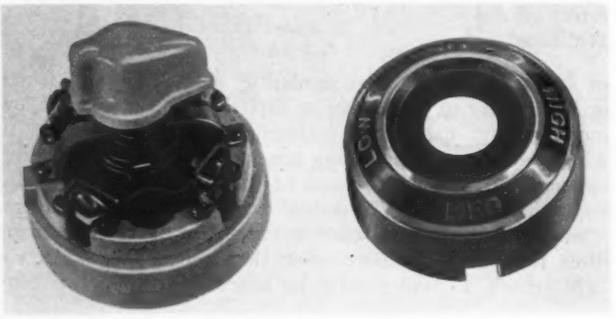
In order to be msot practical the electric range switch had to be designed for simple and easy installation both from the standpoint of permanently fixing the switch itself, and from the standpoint of covering. The latter condition resulted in a number of types of wire terminals to be developed by the various manufacturers, it being in all cases important to design the terminals to receive both solid and stranded wire as the case may be.

The making of electric range switches is in reality a precision job, as comparable to the electric light switch

as the one dollar watch might be compared to the forty-dollar time-piece. To obtain the desired results, the first requisite is, of course, a switch of the best mechanical and electrical design attainable, and this is accomplished only after and with continued experimentation. However, without the correct type of raw material for each component part, the switch would be of little value, regardless of its very fine design. This leads to a very careful selection of the correct material, and a close inspection of all raw material to be certain that it complies with the necessary specifications which have been carefully determined.

An accurate inspection of all component parts fabricated from the raw material is equally as important as the inspection of the raw material itself. Endurance tests accomplished by a continuous operation of the switch under electrical load will show up many of the weak points both as to design and quality of material.

The keeping of accurate heat treatment data for all hardened parts is important to obtain uniform results. Of



On this reversible operating heater control switch, shown with the cover removed, the position indications are obtained by using a stamped cover and an indicating handle

no less importance than any of the previous requirements, is the employment of a higher than average grade of help in both the fabricating and assembling divisions. Although the inspection of raw materials, component parts and finished products is carefully carried out, the employment of a higher than average grade of help, will assist materially in upholding the standards of quality necessary for this type of product.

Appliance Demand in England

(*Continued from page 278*)

appear to know a woman's "proper place." But let me suggest that the seemingly slow development of the home appliance industry in England has not been due alone to John Bull but rather to the indifference of his mate, the Lady Britannica. When a woman in shopping shrugs her shoulders and passes on to the knitted sportswear section the best laid plans of mice, men and electrical manufacturers may well come to naught.

The servant problem is working the miracle here, just as it once did in America. Good servants are not extinct, as they are with us (practically!). There are still eleven housemaids to every stenographer in Great Britain. But girls are going into factories or stores, or they demand such wages that the poorer family can't afford them.

So, the kitchen comes up out of the basement and is decorated with applegreen walls and cream woodwork! The scullery is whitewashed and equipped for a laundry. A vacuum cleaner appears in the hall and tea is served with the aid of an electric kettle.

Not even in electrical America have we an Electrical Association for women with several thousand members and a dozen branches in the larger cities. Not even in our over-journalized United States have we an entirely electrical home magazine with national circulation.

It was a woman, over here, who pounded the table at a certain group of gentlemen for several generations (as it seemed to her) until finally the Electricity Supply Act was passed by Parliament. Her name is Caroline Haslett and she is director of this Electrical Association for women which is establishing model kitchens, equipping electrical homes, instructing women in the use of labor-saving appliances and promoting the electrical idea throughout the whole of Great Britain.

And now, seeing more power on the way to the home, at a more uniform cost per kilowatt hour, these women have taken up the matter of better home wiring and have even drawn up National Specifications for the placing of convenience outlets, etc. Where to attach an increased number of appliances is a pertinent question at the moment, and it may surprise you to know (if you don't know England!) that the womenfolk—not the wiring contractors—are leading the movement to attach the vacuum cleaner somewhere other than to the center lighting fixture!

A quarter million new homes a year are being built and practically all new houses are wired for electricity. To get them wired rightly is the present undertaking of these far-seeing females!

Again and again you hear in America that because of the economic situation over here these people can't afford washers and cleaners. They hardly have enough for food and rent!

But you'd be surprised how many automobiles they're affording! And what prices they pay for theater seats (just try to get in for Elsie Janis!). And the amount of loose change they spend for flowers-on-the-street and taxis-in-the-rain. Folks can buy what they really want to buy.

This doesn't mean, however, that English homemakers will ruthlessly change their homemaking methods in order to "do it electrically." The American exporter of electrical goods must understand the great difference in English homelife and the traditional preferences of these kindred peoples.

Electrical kettles, for instance, will always be more in demand than the American percolator, since England is not a coffee-drinking nation. Cold toast is a digestible breakfast delicacy—not an unpardonable oversight. Therefore the toaster is mainly useful at teatime when buns and scones are served hot with jam.

Waffle griddles are unknown because waffles are unknown, although a long oblong pancake griddle is esteemed as a plate warmer. Table cooking of all kinds is still a novelty. I've only seen one grill in use, and that in a Mayfair tea-shop for toasting cheese and biscuits. (It was an American grill, however, and looking pretty lonesome, so I stepped in and said "hello").

Electric irons, of course, are very general and the preference seems to be for four and five pound weights rather than the American six pound size. But ironers are selling slowly, probably because electric washers are so high in price and the washer usually precedes the ironer in home laundry work. Vacuum cleaners are going well, at a fair price, and American makes are by far the most popular.

And this brings me to a good word about the dawning of brand consciousness. I just heard a woman shopper very emphatically insist on having a "Smoothwell" iron. . . . "I've had my last one for five years without a bit of trouble and I wouldn't think of trying any other kind." When we can establish preference like that for American products our fortune is made.

"The individual purchaser as a rule continues to buy the best he can get for his money," says a British market report. "American electrical goods have established a good name with him. . . ." And a good name in a far country is even more useful than it is at home!

Mechanical Transmission for Motor Drives

*This is the second of three articles having to do with the design and maintenance of the several different types of transmission for motor drives**

WHERE belts become oil soaked, caked up, etc., they may be cleaned by washing in gasoline and then scraping. Before being put in service again, the belt should be dressed.

Following is an example of selection of belt and pulley: A 7½-hp. motor, full-load speed 1165 r.p.m., with a pulley 7-in. diameter by 5-in. belt width, is to drive a machine which should run at 230 r.p.m. Select the proper belt and driven pulley.

The reduction—$\frac{1165}{230}$ = 5.06 represents good practice.

The driven pulley should be 5.06 times the driving pulley or $5.06 \times 7 = 35.4$ in. Introducing the slip factor of 98 per cent, the diameter pulley to actually give 230 r.p.m. is found to be 35.4 in. $\times$ 0.98 = 34.7 or a 35-in. pulley would be selected. The center distance should then be about 9 ft. (35 in. $\times$ 3 = 105 in.).

In figuring the power transmitted, possible overloads and shock loads varying with the class of work must be taken into account. For our purposes let us assume a 50 per cent overload.

Then the hp. = $7\frac{1}{2} \times 1\frac{1}{2} = 11\frac{1}{4}$.

Referring to Table I, the belt speed corresponding to 7-in. diameter and 1150 r.p.m. (taking nearest values again) is 2110 ft. per min. which is well below the maximum allowable speed of 5000 ft. per min.

In Table II, under single belting, we find opposite 2100 ft. per min. that 2.92 hp. can be transmitted per inch of belt width. To transmit 11¼ hp., a belt $\frac{11.25}{2.92}$ = 3.85-in. wide would be necessary. Therefore a regular or medium single-ply belt 4-in. wide (taking next larger standard width) would be selected.

The driven pulley may be 35-in. diameter by 4-in. belt width.

Gear drive is used where fairly large speed reductions are involved and a compact arrangement with close shaft centers is either desirable or necessary, or where a definite speed ratio or "positive" drive is sought. In general, it is not affected by moisture, temperature, or other atmospheric conditions ordinarily affecting other forms of drive. In addition, there is small danger of disconnecting from the load, an important point where series motors are used.

The questions of alignment is probably the biggest limiting factor in the use of geared drive. Any misalignment causes rapid wear, may cause broken teeth, and punishes the motor bearings severely. To maintain proper alignment it is practically necessary for the motor to be mounted on the driven machine or on a base common to the two.

With geared drive all shocks are transmitted directly to the motor, though this effect can be decreased by the use of non-metallic gears. In some cases the fact that there is no slip is a disadvantage as the slip feature is sometimes desirable as a sort of safety valve against momentary overloads.

There are many forms of gearing of which the four more common are:

1. Spur.
2. Herringbone.
3. Worm.
4. Bevel.

Spur gears or herringbone gears transmit power between parallel shafts. The herringbone gears practically eliminate end play, noise and back lash. Because of the lower cost of spur gears, however, particularly on small horsepowers where it is not as necessary to regard the features just enumerated, or where the effect will be less marked, spur gears are almost universally used.

A fairly large reduction can be obtained within a small space by the use of a speed reducer of either the planetary or double type, using either spur or herringbone gears.

* The information contained in this, the second of three articles, and one additional to be published in subsequent issues of ELECTRICAL MANUFACTURING was abstracted from data published by the Small Motor Division, Industrial Department of the General Electric Company, River Works, West Lynn, Mass.

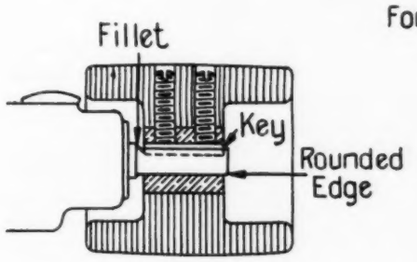


Figure 5. Position of Pulley on Shaft

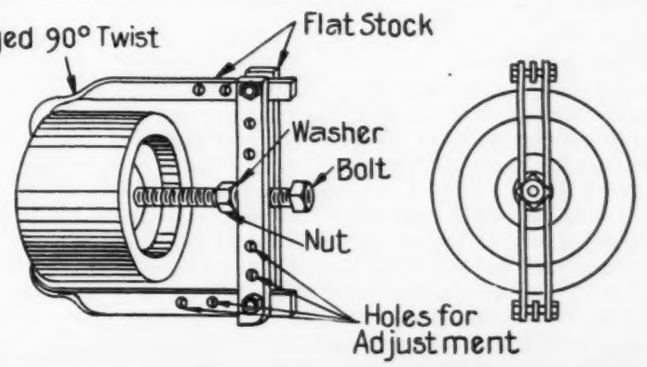


Figure 6. Method of Removing Pulley from Shaft

Figure 9 illustrates one type of planetary reducer. Speed reductions as high as 150 to 1 have been secured by this means. Such a unit has a further advantage of being enclosed for protection in unfavorable locations.

The particular field for worm gears is in great speed reductions. In a worm gear the axes are at right angles. Worm gears are usually run in oil with the worm driving

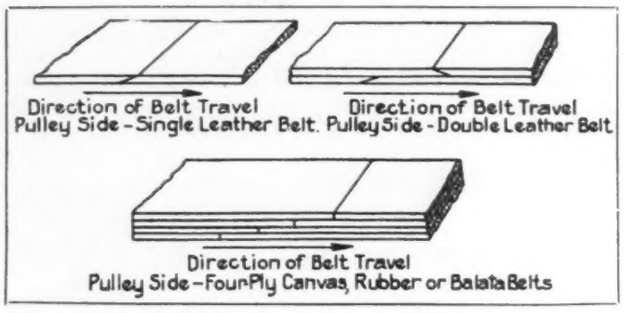

Direction of Belt Travel
Pulley Side - Single Leather Belt.
Direction of Belt Travel
Pulley Side - Double Leather Belt
Direction of Belt Travel
Pulley Side - Four Ply Canvas, Rubber or Balata Belts

Figure 7. Methods of Joining Endless Belts

at the bottom, thus providing the necessary lubrication. Because of the difficulty of cutting a worm and gear, and because of special thrust bearings which must be provided to take care of the extra thrust both of worm and worm gear, it is best to order a complete self-contained unit such as is shown in Figure 10 from some manufacturer specializing in these units.

Bevel gears are used to transmit power between two shafts which lie in the same plane but which do not extend in the same direction. Ordinarily the angle between shafts is 90 deg. With bevel gears special provision should be made for taking up end-thrust.

Noise is frequently a factor. Fabroil gears are practically noiseless, and with a strength equal to that of cast iron are fully capable of being used on most motor drives to accomplish this object of silent operation.

Because more specialized machinery and more involved calculations are necessary to produce and apply gearing than with other forms of mechanical transmission, it is usually best to leave gear problems to the manufacturer to solve. It would be quite impossible to give here comprehensive data on the various forms of gearing, but there are certain accepted standards in spur gear practice which will serve as a rough check on the suitability of existing or projected applications. The following data are given for spur gears.

Before taking up in detail the factors involved in the selection of pinions it would be well to note some of the terms as commonly applied to spur gears. Figure 11 shows the standard gear nomenclature.

The following limitations represent good practice in gearing motors:

TABLE IV—Reduction Ratios for Gearing

HP. Transmitted	Maximum Reduction Ratio
½ hp. and below	10 or 12 to 1
Above ½ hp.	8 to 1

The ratio of speeds of two shafts will be that of the pitch diameters of the two gears or the ratio of the number of teeth on the two gears, the gear of larger diameter, of course, running at the slower speed.

The maximum surface speed considered good practice for spur gears is about 1500 ft. per min. For worm gears the surface speed should be limited to about 300 ft. per min. though a maximum of 800 ft. per min. has been successfully attained. This question of speed is rarely a limiting factor, however, since pinions are kept as small in diameter as possible with a given reduction in order to keep the cost of pinion and gear low.

In theory, practically any horsepower can be transmitted by gears by using a small enough diametral pitch and a wide enough face. In practice, however, gears are not made any width, except for special applications. Stock gears of different manufacturers follow very closely certain well-defined proportions. The relation between horsepower and diametral pitch is shown in the following table based on cast iron or fabroil motor pinions of at least 12 teeth and with face widths approximately as given in Table VI.

TABLE V—Diametral Pitches for Motor Pinions

Motor Hp.	Motor Speed—R.P.M.			
	1800	1200	900	600
	Pitch of Pinion			
¼	10	10	10	....
½	10	10	10	....
¾	10	10	10	....
1	8	8	8	7
2	7	7	6	6
3	6	6	5	5
5	5	4	4	4
7½	4	4	3½	3½
10	3½	3½	3½	3
15	3	3	2¾	2½
20	2¾	2½	2½	2¼
25	2½	2¼	2¼	2
30	2¼	2	2	1¾
40	2	1¾	1¾	1¾
50	....	1¾	1½	1½
75	....	1¼	1¼	1¼
100	....	1¼	1¼	1
125	....	1	1	1
150	....	1	1	1

Figure 8. Common Gear Types

As previously stated, practice varies slightly as to the proportion between diametral pitch and gear width, but the following comparison may be used for cut gears in general.

Table VI—Diametral Pitch Vs. Face Width

Diametral Pitch	3	4	5	6	8	10	12	16
Face Width in In.	3 to 4	2½	1¾ to 2	1½ to 1¾	1¼ to 1½	1	¾ to 1	½ to ⅝

If the design of the gear is to be left to the gear manufacturer the following information is required:

1. Speeds of the two shafts.
2. Power to be transmitted.
3. Maximum or minimum gear diameters. (Fixed by surroundings and by shaft size.)
4. The center distance, stating also whether this center distance is fixed or adjustable.
5. Exact bore.
6. Length of shaft extension.
7. State whether key, set-screw, or both are desired.
8. If keyed, give size of keyway.
9. Nature of drive.

Cut gears should always be specified for motor drive. In ordering gear and pinion it is better to order both from the same manufacturer in order to avoid any possible mistakes due to the use of different size cutters.

If the gear has already been decided on, it may be obtained by specifying:

1. Material.
2. Diametral pitch, or circular pitch.
3. Number of teeth.
4. Pitch diameter.
5. Face.*
6. Exact bore.
7. State whether key, set-screw or both are desired.
8. If keyed give width and depth of keyway.
9. State length of hub (length of shaft extension on motor determines maximum).
10. Nature of drive.

* Fabroil gears are made up of a cotton filler held in compression between steel shrouds. For fabroil gears to operate noiselessly, the shrouds must not engage with the mating gear. The face width between shrouds must, therefore, be equal to the mating gear plus an allowance for end play (about 1/8 in.). In giving "face width" specify whether fabroil face —distance between shrouds—or overall face is intended.

Pinions are mounted on the driving shaft with either straight or tapered shaft extension. Non-metallic gears (fabroil and textolite) are ordinarily machined for a driving fit on the shaft, but steel pinions may require other means of mounting. If the pinion be dropped in boiling hot water and allowed to heat through, it will usually expand enough to allow ready mounting. The pinion bore in these cases is usually 0.001 in. less than the shaft diameter.

Where quick or fairly frequent removal of the pinion is necessary, tapered shafts with lock nuts should be specified. Flames, forges, torches, etc., should not be used to heat the pinion preparatory to mounting because of the danger of annealing the teeth or warping the gear. In removing gears a pinion puller should be used in preference to heating the pinion hub, as the latter method may warp the shaft.

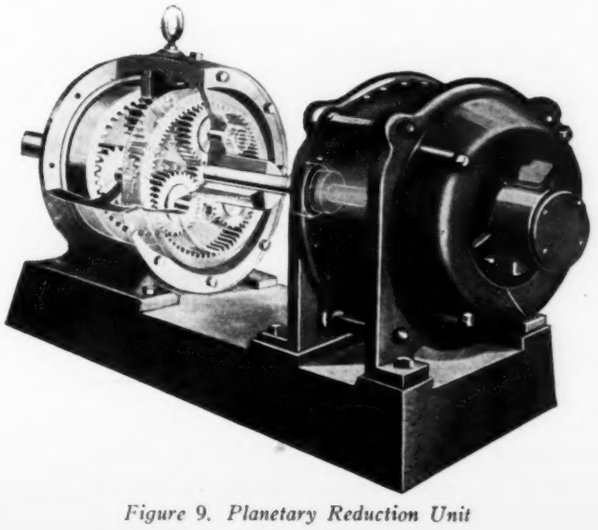


Figure 9. Planetary Reduction Unit

Oftentimes geared drive apparently calls for special shaft extensions because of space limitations. The use of such special extensions can be frequently avoided by various arrangements similar to those shown in Figure 14.

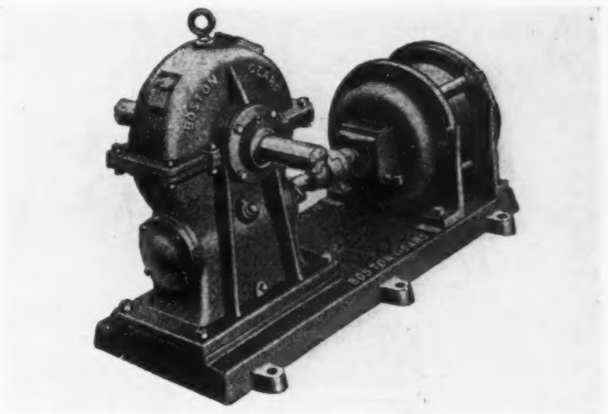


Figure 10. Worm Gear Reduction Unit

There are many installations where encasing the drive is not practicable, but where it can be done, geared drives should be encased. This not only is better from the standpoint of safety, but also allows the gears to be run in an oil bath, which makes a more quiet running unit and one which will insure longer life to the gears.

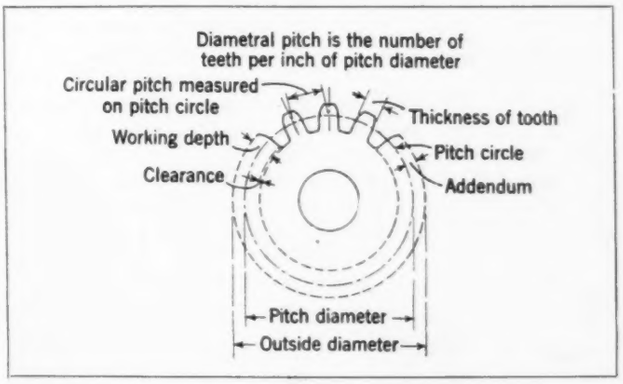


Figure 11. Standard Gear Nomenclature

Gear cases may be bought from manufacturers making a specialty of this product, or the case may be made up locally from sheet metal. The easiest method of making such a case is by welding, using hot-rolled sheet steel of about No. 12 gage. The casings should be split along a line connecting the centers of the two shafts, with clips either welded or riveted to the casing for support. The joint between the two halves may be of the lap type, that is like a cover fitting over a box, or a gasketed joint can be made where it is desired to have a particularly tight joint. Ordinarily it will be found more convenient to hinge the upper half to the lower, the clip supports being on the lower half only. About ½-in. clearance should be left on each side of the gear, with about 1-in. clearance around the circumference of the gears.

An example of selection of gears follows: A 5-hp. motor, full-load speed 1750 r.p.m., is to drive a shaft at 580 r.p.m. Center distance 11 in. Select a pinion and gear.

Maximum load = 5 hp. × 1½ = 7½ hp.

From Table V select a 4-pitch gear.

Speed ratio = 1750/580 = 3.02:1 (approx.)

The radii of gear and pinion will then be in the ratio of 3.02 to 1 or the gear radius will be $\frac{3.02}{3.02+1}$ of the center

distance, and the pinion radius will be $\frac{1}{3.02+1}$ of the center distance. Gear radius $= \frac{3.02}{4.02} \times 11$ in. $= 8.26$ in. (approx.) $= 16.52$ in. dia.

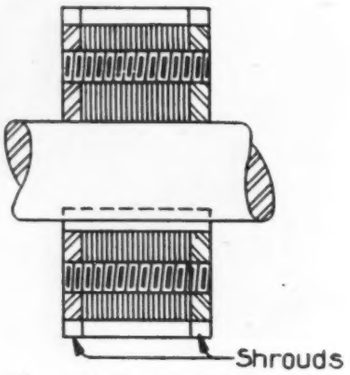


Figure 12. Section of Fabroil Gear

A four-pitch gear would then have $4 \times 16.52 = 66.08$ teeth. Use 66 teeth.

Pinion radius $= \frac{1}{4.02} \times 11 = 2.74$ (approx.) $= 5.48$ in. dia. Pinion would then have $4 \times 5.48 = 21.92$ teeth. Use 22 teeth.

Working back:

Diameter of gear $= \frac{66}{4} = 16.5$ in.

Diameter of pinion $= \frac{22}{4} = 5.5$ in.

Sum of radii just equals center distance of 11 in., therefore, a four-pitch gear and pinion with about a 2½-in. face (Table VI), with 66 and 22 teeth respectively will be satisfactory. This gives a driven-shaft r.p.m. of 583.

Silent chain drive is used where positive drive is desired, but where the center distance is too great for gearing, or where the center distance being too great for gearing is still so short that belting would not operate satisfactorily. Silent chains operate at high efficiency (90 to 98 per cent), have no backlash, and maintain these features throughout their life. Under proper conditions they are nearly silent—only belting and direct connection are more so.

With silent chain drive the maximum reduction ordinarily recommended would be about 8 to 1. This ratio would be roughly realized by the use of a sprocket with a minimum of 15 teeth and a gear with a maximum of 120 teeth. These limits must be observed if the application is to be successful.

Silent chain drives are run in air or in oil. Silent chain drive in air should run at not more than 1400 ft. per min.; in oil not more than 1800 ft. per min. Chains operating in air have a lower speed limit because oil is thrown off at high speeds leaving the pin bearings dry. Above 1800 ft. per min. the centrifugal tension becomes a limiting factor.

The maximum center distance depends on the arrangement of drive, application, size of sprockets, and whether or not means of adjustment are provided. With long center distances and horizontal drives, an excessive pull is put on the bearings while the danger of fouling is increased. A maximum center distance of about 12 ft. is recommended.

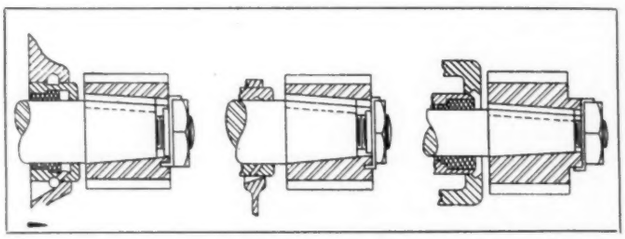


Figure 13. Methods of Mounting Pinions on Tapered Shafts

While it is true that with short centers the chain may be subjected to more wear than otherwise, because of the small number of parts in operation, it is perfectly satisfactory to adopt a minimum center distance equal to the diameter of the larger sprocket plus the radius of the smaller. *(To be Continued)*

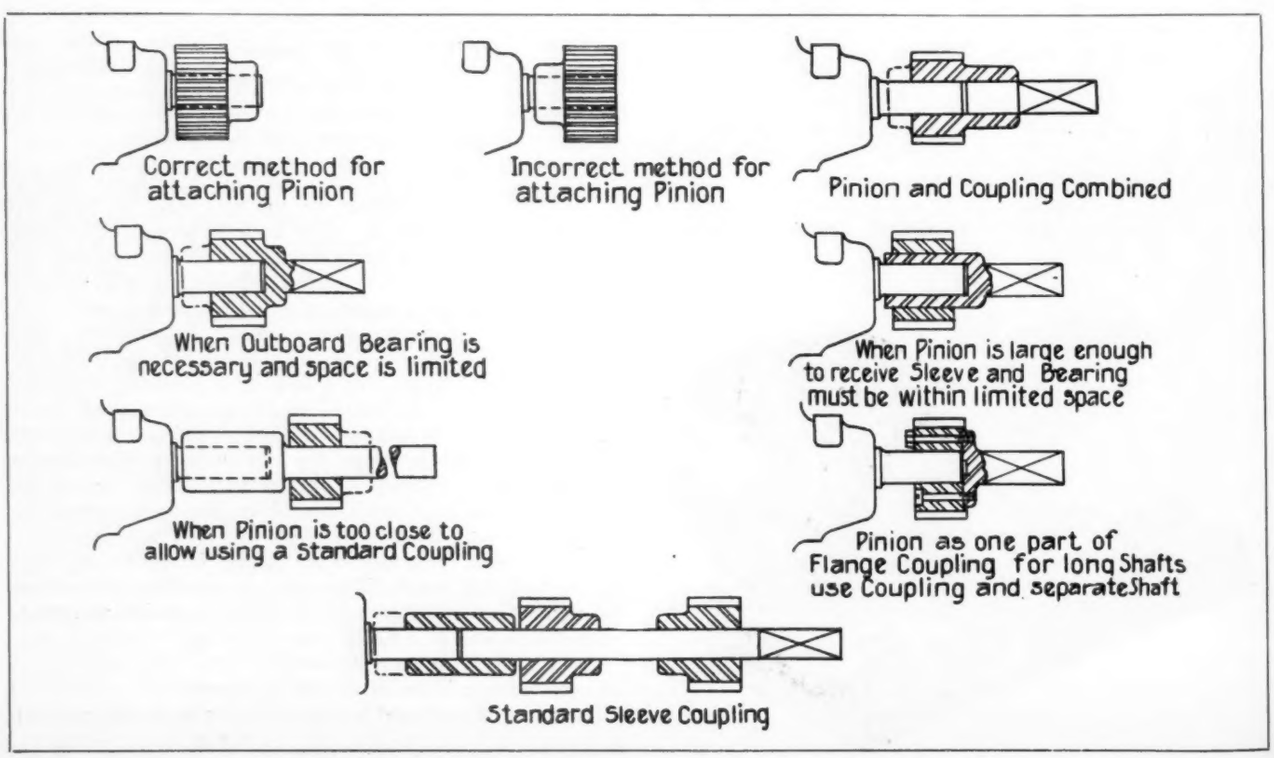

Correct method for attaching Pinion
Incorrect method for attaching Pinion
Pinion and Coupling Combined
When Outboard Bearing is necessary and space is limited
When Pinion is large enough to receive Sleeve and Bearing must be within limited space
When Pinion is too close to allow using a Standard Coupling
Pinion as one part of Flange Coupling for long Shafts use Coupling and separate Shaft
Standard Sleeve Coupling

Figure 14. Methods of Mounting Pinions on Standard Shaft Extensions

OFFERING Manufacturers Prospective Markets in Foreign Countries

*An outline of the functions of the Electrical Equipment Division of the Department of Commerce and its services to manufacturers and importers**

By Marshall T. Jones

Chief, Electrical Equipment Division Bureau of Foreign and Domestic Commerce

ORGANIZED in September, 1921, the Electrical Equipment Division of the Department of Commerce was designated to supply the electrical manufacturers interested in exporting with information as to foreign markets to cultivate and methods to employ.

The division's field of commodities includes electric power plant equipment, telephone and telegraph apparatus, electric lighting fixtures and lamp bulbs, appliances such as washing machines, irons, toasters, etc., in fact, anything connected with the electrical industry. Radio apparatus, both transmitting and receiving, comes under this jurisdiction.

Originally trade information was disseminated only by means of correspondence and mimeographed special circulars. To these now have been added printed bulletins and various publications, weekly articles prepared in the Division for Commerce Reports, and other means of distributing information as special occasions arise.

Marshall T. Jones

Several intensive reviews of foreign electrical markets were issued by the bureau prior to the organization of the division, which served as reference. Since September, 1921, 30 printed publications have been prepared in the division, 22 of which it originated; and 584 mimeographed special circulars, and over 100 other mimeographed communications dealing with all phases of foreign trade in electrical equipment, have been sent out. With but one or two exceptions, an electrical article of general interest has appeared in each of the nearly 400 issues of Commerce Reports issued since that date. Issuance of a weekly bulletin entitled "Electrical Foreign Trade Notes" was begun a year and a half ago to serve as a medium for short notes on world electrical markets, and to act as a connecting link with industry for notices, etc. Correspondence has seldom failed to provide a specific demand for research requiring a very large part of the working time of this division.

One of the first difficulties standing in the way of aiding electrical exporters was the lack of sufficiently detailed export statistics. There were but a very limited number of classes, and these indefinite. Serving their purpose very well for indication of the export business as a whole, they were practically worthless for helping in the analysis of markets for specific classes of goods. With the cooperation of the electrical equipment industry, a revision of classifications along lines of much greater detail was accomplished. Now there are 75 export classes of electrical goods.

To render this revision effective, the "Glossary of Electrical Terms and Instructions to Exporters" was compiled and published. This glossary is issued free. Its sole aim is to bring about cooperation between the individual exporters and the department in properly indicating exported goods on export declarations, so that statistics may be fully indicative of their part in market analysis.

Electric current characteristics present a condition peculiar only to electrical equipment marketing. Everything electrical must be differently designated for different voltages, and motors, meters, and some other classes, are very particular as to whether the current is alternating or direct, and if the former, what frequency. Some require even further modifications. Unless all these specifications are met, a device is useless.

Prior to the establishment of the electrical division exporters without definite advices did one of two things—they guessed, or delayed filling an order to inquire by correspondence or cable. The electrical division, however, as one of its first activities provided for this need by establishing a file of central station characteristics, a file which has been kept up-to-date and in as efficient a form as possible. Material on most cities in all countries is now available, and the ultimate aim is to have this necessary informa-

*Abstracted from an article by Mr. Jones published in the United States Daily.

tion in printed bulletin form to cover the world. In addition, a series of circulars on what current costs abroad, is now nearly completed.

Another service file maintained in the division is that in which foreign radio broadcasting stations are listed. From time to time, since its inception, lists showing all stations have been mimeographed. This has proved one of the most popular and useful of the minor publications of the division.

The "Exporters' Index," the official mailing list of the Bureau of Foreign and Domestic Commerce, of American firms interested in export, has an electrical section of considerable importance. As originally made up, this list contained the names of only 200 firms manufacturing and exporting electrical equipment who were desirous of employing the services of the division. At the present time approximately 1200 firms are listed.

Foreign Trade Activities

OF specific help to individual firms, the Department of Commerce service of actually interesting foreign firms in undertaking the representation of American firms in their respective countries is very definite as to results obtained, which can really be measured by the volume of business resulting, per annum. This type of aid, through the bureau's foreign offices in the principal cities of the world is steadily growing.

For example, a household electric refrigerator manufacturer, already enjoying a small export trade, wishes to enlarge that part of his business. By writing to the division and stating his problems, or better still, sending a representative to Washington, he is requested to supply literature of his product, with prices, etc., which is dispatched to our offices abroad with the request that if possible a suitable agent be interested.

A development within the past year has been the exchange of monthly export statistics between the United States on the one hand, and Germany and Great Britain on the other. The American electrical exports, by classes and countries of distribution, are sent to our Berlin and London offices, and through the cooperation of the respective electrical associations there we receive the German and British figures, which are made available to the American manufacturers and exporters, in detail as to countries, not heretofore published—as these three countries control approximately 90 per cent of the world trade in electrical goods, such compilations are very useful.

A map is now being prepared in the division, which when completed, will show the location of practically every power plant in the world, different colors denoting capacities in kilowatts. So far as is known, this is the only map of its kind in the United States. In addition, a map of the United States is now being prepared upon which will be shown the locations of factories of electrical and radio companies interested in exporting.

Data on wiring practices abroad, regulations as to installations of electrical equipment, underwriters' requirements, if any, and varied and sundry information are available to the American exporter. Through the various other divisions of the bureau information is supplied on foreign tariffs, trade regulations, trademark protection, commercial reports on foreign firms, and a multitude of other useful and necessary items.

While all the foregoing is in connection with foreign trade, one phase of the division's activity embraces a quarterly survey of radio dealers' and wholesalers' stocks on hand in the United States in which also is tabulated receiving sets sold per year and the volume of business in dollars. By tabulating according to population groups per State, invaluable distribution information is obtained. This survey is carried on with the aid and cooperation of the Radio Division of the National Electrical Manufacturers Association. It was instituted one year ago, the fifth one is now being tabulated, and is resulting in the establishment of statistics that should grow in value.

Practically ever since the division was established a subcommittee composed of three members of the Department of Commerce committee of Nema has acted as a guide for the division, both in planning out what should be done and cooperating to see that it was put into effect. Last spring this small committee was disbanded and the division now works directly with the main committee. Naturally it has been helpful to have these men to call upon in an advisory capacity so that the work of the division was carried along lines considered to be the most worth while to the industry.

To sum up the service to the exporter, practically every phase of the work is carried on, from advising as to what countries in which to market, to reporting on damaged merchandise shipped abroad, except that the bureau does not actually sell goods for the manufacturer. Most of the foreign offices have been supplied with an Electrical Trade Catalog, to further aid in locating American firms' names for inquiring foreign visitors.

Since 1922, electrical exports have steadily increased from $58,000,000 to $102,000,000 in 1927. So far this year they are ahead of last year by some $6,000,000, and the Electrical Equipment Division is striving to render such excellent service that these exports will continue to forge ahead.

Industrial Engineers

(Continued from page 275)

with anyone else. The increasing application of engineering principles and methods in all kinds of businesses, and in all branches thereof, testifies to that. Therefore, it is up to the engineer to develop a new viewpoint as to his position in industry, and his obligation to the people whom it serves.

The engineer therefore must work toward the executive direction of industry, and coincidently improve or expand his knowledge not only of those factors which make for successful and profitable management but also those which prevent or retard its attainment.

Corporation tax returns show that barely half of the 400,000 firms reporting make a profit. The other half endures a deficit. Surely this is not the best we can do. This condition represents the great opportunity for the industrial engineer to step in, and improve the situation. He can do it, first, by getting his own house in order, putting his own business on a paying basis. Second, he can cooperate with his fellow engineers in the same industry to a greater degree than he does now. Every trade association ought to have an industrial engineer as advisor to its board of directors. If more of the executive secretaries and managers of these associations were trained industrial engineers, their industries would be better served. Third, the industrial engineers of a community can be of great help in stabilizing industrial conditions by cooperating with their local Chambers of Commerce.

We need more industrial engineers in public life. It is difficult to understand why engineers have played so small a part in the political history of this or any other country. Perhaps it is due to the character of an engineer's training, his detachment by circumstance and disposition from matters savoring of politics. Yet we are living in an engineering age, our every day life is involved in it, and it seems that almost without exception our legislators and our political executives, even as many of our business executives, lack the exactitude of reasoning and clear thinking an engineering training imparts. Both these faculties are vital to the efficient control, management and utilization of natural forces and resources. They are no less important in city, State, or national administration than in business administration.

Helping Industry and the Nation to Progress

(*Continued from page 272*)

which, however disadvantageous in maladjustment, were but a detail in the entire scheme. It went on record as calling for the establishment of a non-partisan tariff commission which would take the work of tariff-making out of the hands of politicians and establish it on a plane of scientific endeavor by intrusting the work to men qualified by training, experience and study to do it properly.

It worked in season and out for the extension of the home markets and our foreign trade, and as indispensables of these aims it sought the enactment of legislation for the creation of the office of secretary of commerce, the reform of the consular system, improvement of the country's waterways system, and the restoration of the American flag to the seven seas.

The most casual study of the declaration of principles adopted at Cincinnati reveals that the accomplishment of the first principle stated—that for the retention and extension of home markets and the extension of our foreign trade—was dependent on four other principles constituting the entire body of five. The inclusion of reciprocity in trade relations, the rehabilitation of the merchant marine, the construction and operation of an isthmian canal and the improvement of the country's internal waterways system to supplement its land transport system—all were vital to the success of our domestic and foreign trade.

All of these objects have been achieved, and more. New times bring new problems, and a nation that is progressive may not be static. The formation of the association in 1895 had been the needful thing to arouse manufacturers, to hearten them, to stir them to new efforts to avert disaster, and the manufacturers, by organizing nationally, had been inspired to work out their own salvation and to save the country. Having done this, it was not content to be satisfied, but realized that unremitting effort was necessary to maintain industry in its prosperous state and to advance it to ever new heights.

Local Functions of the Association

TO recite the measures advocated and striven for by the association through its thirty-three years of existence is to call the roll of the constructive ideas and reforms that have made the last quarter century one of the most notable in American history for its social, economic and industrial progress. A recapitulation of outstanding performances may be mentioned, such as:

Its relentless campaign for the construction of the canal across the Isthmus of Panama, a project now complete and on a self-sustaining basis; the successful advocacy of the establishment (accomplished in 1903) of a Department of Commerce; its signal success in the extension of our foreign trade, for the particular assistance of which the association maintains a large foreign trade department, with correspondents in all sections of the world; its constant insistence on the strengthening of our consular service, which had for years been one of the weakest arms in our body international; its successful campaign for the establishment of a parcel post service, now doing a business for the government running into millions of dollars; its foremost activities for the development of an American Merchant Marine, constructed, owned and operated by Americans; its constant appeal for improvement in our immigration policy and methods so that, above all, the future citizenry of the country will be the all-important consideration; its repeated efforts for the adoption of a permanent forestry policy looking to the preservation and control of our forests; its continual fight to uphold the constitutional right of a man to work where he pleases, irrespective of membership or non-membership in any organization; for the improvement and interrelation of our great transportation systems, land, water and rail; for the development of international freight transportation; for improvements in our harbors and inland waterways; for the stabilization of private employment relations; for the reclamation of arid land by irrigation developments; for the equalization of the burdens and responsibilities of all corporations under the law, and for the industrial betterment, health and safety of employes, expert advice being provided on such subjects as employers' liability, workmen's compensation, insurance, accident prevention devices, shop organization for safety and industrial hygiene.

While functioning as a national body, the leaders of the association realized the value of work on a decentralized basis and inaugurated campaigns for the organization of state manufacturers' associations. Their efforts were rewarded by the formation and development of many such organizations, and to coordinate their efforts, thus eliminating unnecessary duplication of effort, the National Industrial Council was organized by the association.

The National Industrial Council

THE National Industrial Council is a federation of over three hundred associations of manufacturers and employers, both local, state and national in character, who are affiliated with it. On national matters it is the recognized medium for expression of industry as regards legislation. It was organized in 1907, with the following purposes:

A—A connecting link and national clearing house on industrial legislative matters.

B—Maintain a legislative bureau and staff at Washington.

C—Keep affiliated bodies accurately and progressively informed respecting pending and proposed national and State legislation affecting them.

D—Endeavor to correlate the efforts of industrial associations when their interests are common.

The council is composed entirely of associations and does not accept membership of any individual business concern. The government of the council is lodged in the hands of its executive committee, which is assisted in its duties by the committee on public policy and the advisory committee.

Present members of the executive committee are:

Chairman, John E. Edgerton (also president of the National Association of Manufacturers); William H. Barr, William H. Barr., Inc., Buffalo; D. M. Weir, Weirton Steel Co., Weirton, W. Va.; George Vits, Aluminum Goods Manufacturing Co., Manitowoc, Wis.; Charles B. King, Marion Steam Shovel Co., Marion, Ohio; secretary, Michael J. Hickey.

The council embraces in its membership more than three hundred local, state and national trade associations. The organization of the council was followed some years later by the organization of the National Industrial Conference Board, in which the association collaborated with other bodies. The formation of this board was prompted by the necessity for a research agency for the collation of data requisite to intelligently carry on the work of the association. And, with a similar broad interest, the association had an active part in the organization of the United States Chamber of Commerce.

Applying Insulating Materials

(*Continued from page* 291)

the consistency of the varnish used. A medium size of nozzle should be used, with high air pressure, to permit fine powdering of the varnish, quick escape of the solvent and rapid drying. The spraying operation requires a little more varnish than hand brushing, not on account of losses in the air, but because heavier coats are applied, but in the end a better job is obtained. When spray guns are used, it is important that they should be washed frequently with the solvent of the varnish used to keep the nozzles and varnish container clean.

Solvents or Reducers For Thinning Varnish.—The solvent used to thin an insulating varnish should be that recommended by the manufacturer of the varnish, and this solvent should be used strictly as recommended to obtain best results from the application and baking of the varnish. In what follows, details are given on thinners and reducers used by the Sterling Varnish Company in connection with their insulating varnishes. The information applies to all but spirit finishes. These spirit finishes are usually solutions of gums in denatured or wood alcohol. They dry after the elimination of their solvent and regain the original state of the simple gums from which they are made. Spirit finishes are expensive and in general do not provide the insulation that can be more easily and safely applied by other varnishes that do not use denatured or wood alcohol as thinners.

The thinners for most insulating varnishes are either petroleum or coal tar distillates, or a mixture of the two. Petroleum distillates that make good varnish thinners are becoming more and more difficult to obtain. It is therefore unwise to buy such products under a trade name, unless the exact composition is known. A pure, narrow cut (containing no fractions, distilling off at either very high or very low temperatures) naphtha, benzine, or gasoline, free from paraffine, grease and heavy oil, and mixing with the varnish without livering or curdling it, should be procured. Its specific gravity should be as near that of the original solvent as possible. Once a suitable product is obtained, its gravity should be taken and specified on future requisitions. If it is far from that of the original reducer, allowance should be made in thinning. It is a general rule that the heavier the thinner the less of it is needed to obtain a coat of given thickness or proper running qualities with a given varnish. It is also true that the heavier the thinner, the more there is of it in a varnish of given weight and composition.

It is sometimes found that a varnish which has been repeatedly thinned, though showing proper gravity, seems to run more, show less filling power and need a somewhat longer baking period. This is due very probably to the fact that a too widely cut thinner has been used. Its lighter fractions have slowly evaporated and the heavier ones only have been left behind. A point may thus be reached where the varnish at a given gravity really contains less base and more, though heavier thinner. The best thing to do under such conditions is to let still more thinner evaporate and use the varnish at some heavier gravity that test shows to give the desired protection.

The coal tar distillates used for varnish thinning are heavier than those derived from petroleum. They show better solvent powers for most varnish bases, are more homogeneous and narrower cut. They should not be used for varnish employed for treating enameled wire coils. Solvent naptha of about 160 deg. Fahr. is probably the best product for this class for thinning. For black varnishes a similar product of darker color is often used.

When thinning insulating varnish, it is wise to make sure that both varnish and reducer are at about the same temperature. Then add the thinner gradually, stirring it in thoroughly all the while. Cold thinner added too rapidly is liable to throw the varnish base out of solution. Large quantities of thinner will often cause the same result, especially if put in too quickly. Warmth assists the union. It is therefore better that both varnish and thinner be at a temperature of at least 70 deg. Fahr. Stirring after the addition of the thinner should be continued until one is assured of the entire homogeneity of the resulting product. This can be determined by the "feel," the way it runs off the paddle after stirring and the absence of streaks on the surface of the varnish under reflected light. A good tool for stirring large quantities of varnish effectively is an ordinary canoe paddle.

If, though the thinner mixes in perfectly, the varnish gradually seems to change with successive thinnings, a test should be made to determine the quality of the thinner and the percentage present in the varnish. In making such examination, one should proceed after regular laboratory methods. If the thinner, upon being carefully added, seems to precipitate the varnish base, it is probable that it does not have the necessary solvent powers. This can often be corrected by the addition of a small percentage of benzol.

Insulating varnish as supplied by a manufacturer should have such a consistency and viscosity as to make its uniform application easy, with the least amount of solvent to make this possible. In other words, it should have the largest amount of base or useful material. The adding of solvent then is all that is required to provide the proper specific gravity as used at the temperatures at which it is applied. A table of specific gravities for different temperatures is included in this article. To obtain the best results from insulating varnish, it should be kept at as nearly as possible the same temperature the year around and not be allowed to fall much below 70 deg. Fahr.

The tables and drawings accompanying this article were taken from the Data Book of the Sterling Varnish Company, Pittsburgh, Pa.

Semi-Automatic Starters

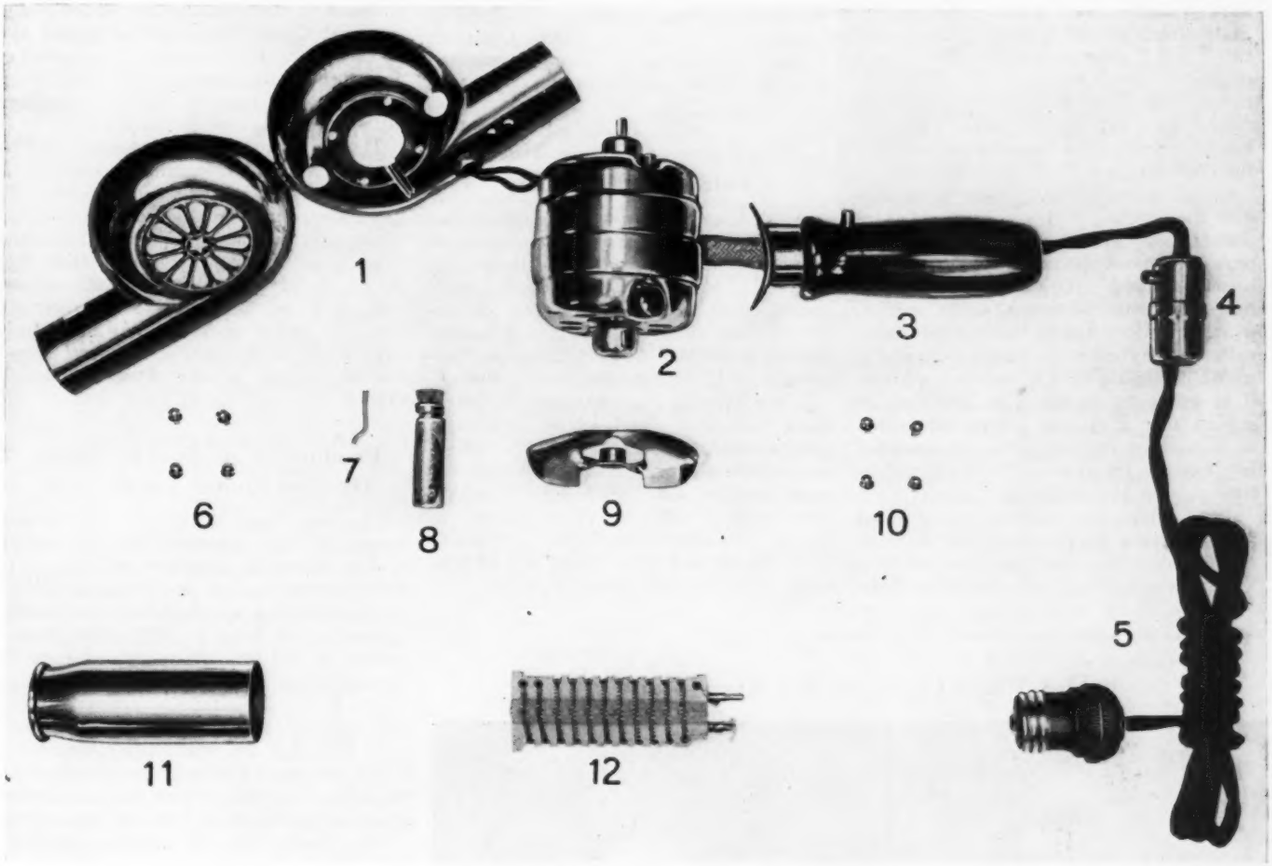
(*Continued from page* 303)

pensator switch is moved to the "run" position, a field actuating relay is energized. When the motor accelerates to approximately 95 per cent speed, this relay operates to close the field contactor, applying D. C. excitation to the motor field. The field contactor and field relay together with a line and field ammeter are mounted on a base, on the same framework with the compensator. Provision is also made for mounting either an exciter or motor field rheostat, or both. This provides for proper adjustment of the field excitation. The instruments afford visible evidence of the performance of the motor.

The semi-automatic starter is available for use on circuits up to 6600 volts, and affords protection against undervoltage, overload, and loss of D. C. excitation. A combination reset and stop button conveniently located on the compensator case, is pressed either to stop the motor or to reset the overload relay after it has tripped.

Hair Dryer Components

The manufacturers of air blowing dryers require eight different raw materials in addition to small motors in the making of their products



ELECTRICAL MANUFACTURING *acknowledges the assistance of the Ideal Service Company, 57 Walker St., New York, N. Y., in the preparation of the illustration of hair dryer parts*

Have you overlooked the possibilities of the market for raw materials and parts among the 26 manufacturers of electric air blowing dryers, such as hair and hand dryers?

Part No.	Description	Material
1	Fan housing	Steel
2	Motor	
3	Handle and heater switch	Wood, fibre, copper, brass, steel
4	Motor switch	Steel, fibre, copper, brass
5	Cord and plug	Wire, insulation, copper, brass, hard rubber
6	Fan housing screws and lock washers	Steel
7	Oil tube	Steel
8	Oil	
9	Fan blade	Steel
10	Handle screws and lock washers	Steel
11	Blower nozzle	Steel
12	Heating element	Porcelain Resistance wire Brass

Electrical Manufacturing News

A department containing news and descriptions of new materials, parts, devices and special tools for the manufacture and repair of electrical products

Tariff Conditions Discussed at Manufacturers' Meeting

A large variety of industries, representing almost every state in the United States, sent delegates to the meeting of the Tariff Conference, under the auspices of the National Association of Manufacturers, held at the Hotel Waldorf-Astoria, New York City, Nov. 26. John E. Edgerton, president of the association, addressed the opening remarks to the conference.

In his address, Mr. Edgerton declared that the meeting had not been called to discuss how great the country needs a protective tariff policy that has already been questioned. It is a question now of how that policy is going to be applied, whether it is going to be applied politically by Congress in the bunglesome way it would be applied by Congress, or whether it is going to be taken as the sort of subject that it is, and committed as far as possible to a body properly equipped for treating the question as it should be treated, said Mr. Edgerton.

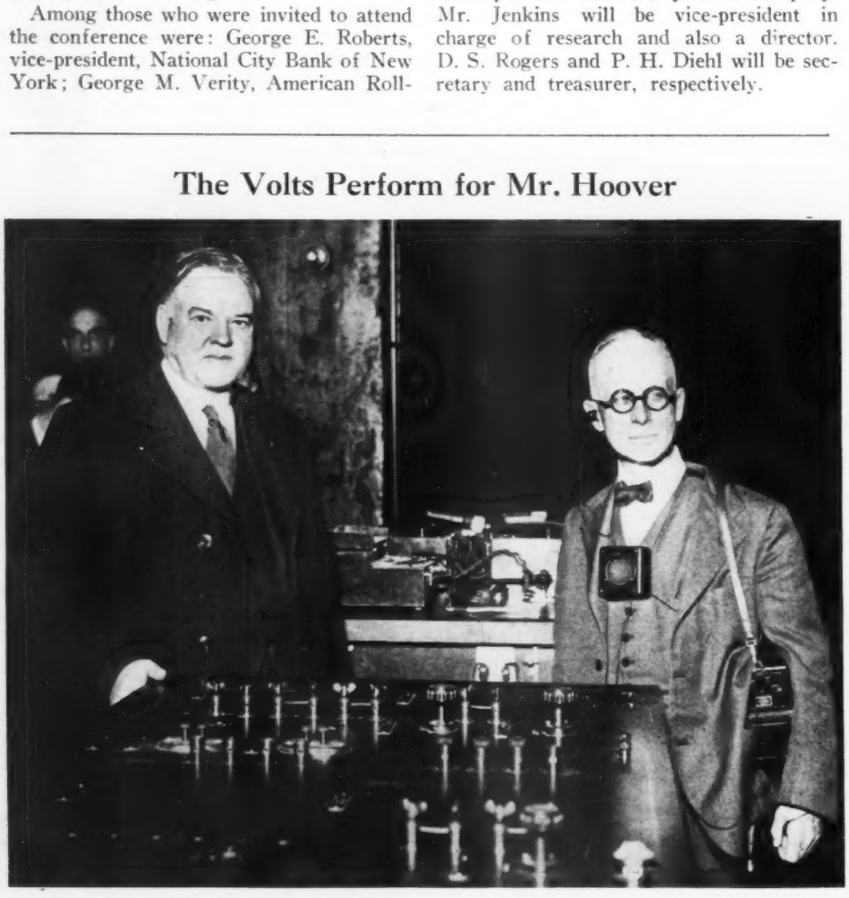
Among those who were invited to attend the conference were: George E. Roberts, vice-president, National City Bank of New York; George M. Verity, American Rolling Mills Company, Middletown, Ohio; Harry Chandler, Times Mirror Company, Los Angeles, Cal.; A. L. Humphrey, president, Westinghouse Air Brake Company, Pittsburgh, Pa.; James A. Campbell, Youngstown Sheet & Tube Company, Youngstown, Ohio; S. Regar, treasurer, Chandler Motor Car Company.

Wall Street Group Forms Television Company

A syndicate of bankers has undertaken the commercial production of television apparatus and has formed in Delaware the Jenkins Television Corporation, with capitalization of 1,000,000 shares of no-par common stock. The firm will market the television and image transmission apparatus of C. Francis Jenkins.

James W. Garside, president, DeForest Radio Company, will head the new company while A. J. Drexel Biddle, Jr., chairman of the DeForest board, will hold the same position with the Jenkins company. Mr. Jenkins will be vice-president in charge of research and also a director. D. S. Rogers and P. H. Diehl will be secretary and treasurer, respectively.

The Volts Perform for Mr. Hoover



Before leaving on his South American tour, President-elect Herbert Hoover paid a visit to Leland Stanford University, where he was the guest of Prof. H. J. Ryan, head of the high voltage laboratory which bears his name. The picture above shows the two men at the control panel of the apparatus which produced two million volts in a special demonstration

Supreme Court Rules Against Radio Corp. of America

The Radio Corporation of America has failed in its effort to have the United States Supreme Court review an injunction restraining it from enforcing a license agreement with manufacturers of radio receiving sets, requiring them to purchase all their tubes from the R. C. A.

The corporation had maintained that it was in a position to drive competitors out of business through the possession of patents covering circuits used by all manufacturers, but had consented to competition if all tubes were bought from the R. C. A. The De Forest Radio Company and other manufacturers asserted that the patent covering the tubes had expired in 1925, thus permitting every one to engage in the manufacture of tubes.

Production of Socket Power Devices Shows Large Gain

The Department of Commerce, Washington, D. C., announces that according to data collected at the biennial census of manufacturers taken in 1928, establishments engaged in the manufacture of radio apparatus and tubes in 1927 reported an increase of 8.4 per cent as compared with the production for 1925, the last preceding census year. Tube-type receiving sets in 1927 fell off 19.1 per cent as compared with 1925, but the production of socket-power devices in 1927 aggregated 1,405,191, or 13.4 per cent of the total value of radio apparatus manufactured during the year.

The manufacture of batteries in 1927 represented a decrease of 3.1 per cent over 1925. The production of storage batteries, six-inch dry cells and wet primary batteries showed a considerable decrease in 1927 as compared with 1925. Radio B and C and flashlight cell production, however, increased 32.2 per cent in 1927 as compared with the former year.

New Equipment Demonstrated at Power Exposition

An opportunity was offered engineers, industrial executives and all users of power and mechanical equipment to inspect a record number of products which were exhibited for the first time at the National Exposition of Power and Mechanical Engineering, week of Dec. 3, Grand Central Palace, New York City. Five hundred twenty-seven exhibitors, showing products from every state in the United States and several foreign countries, displayed their equipment.

The exposition also featured a large number of educational exhibits. An elaborate program of films showing engineering and industrial processes and progress

was displayed in a specially built auditorium. This year, as during December, 1927, more than 110,000 engineering and industrial executives attended.

Brazilian Radio Trade-mark Draws U. S. Protest

An attempt in Brazil to secure exclusive trade-mark rights to the word "radio" has caused an official protest by the United States Government. The Radio Manufacturers Association has been advised by the Federal government that the protest will probably be successful.

Acquisition of the exclusive rights to the word "radio," would virtually have barred all American radio exports to Brazil. The Foreign Trades Committee of the R. M. A., headed by George H. Kiley of New York, took prompt action to protect the rights of American manufacturers, and a vigorous protest was made to the Department of Commerce. The State Department has cabled the American Embassy at Rio De Janeiro to request cancellation of the trade mark on the grounds that it is a violation of the Santiago trade mark convention of 1923, to which both the United States and Brazil are parties.

Westinghouse Closes Deal with Finance Company

Commercial Investment Corporation announces that a contract has been closed with Westinghouse Electric and Manufacturing Company, under which the C. I. T. will extend the financing facilities heretofore provided by the Westinghouse Acceptance Corporation, a finance subsidiary of Westinghouse Electric.

The Westinghouse finance organization was formed a number of years ago to offer installment financing service to manufacturers and dealers selling a product containing Westinghouse equipment. It has maintained a national organization serving many manufacturers and distributors of washing machines, electric refrigerators and other domestic and commercial appliances. The C.I.T. was recently adopted as the official financing agency for the Radio Corporation of America. Expansion of the C.I.T. business during the current year has led to an increase of capitalization from $28,000,000 to $42,000,000.

Domestic Electric Merges with Black & Decker

Announcement has been made that the Domestic Electric Company, 7223 St. Clair Ave., Cleveland, Ohio, and the Black & Decker Manufacturing Company, Towson, Baltimore, Md., have merged interests. The latter company, manufacturer of electric drills and hammers, is now enabled to make all parts and materials for use in its products, as a result of the acquisition of the plant of the Domestic Electric Company, manufacturer of fractional horse power motors.

Carl A. Duffner, president and general manager of the Domestic Electric Company, will remain in his present capacity, as will Alfred N. Kellogg, treasurer, and Milton H. Spielman, vice-president. S. D. Black is president of the Black & Decker Company and Alonzo G. Decker, vice-president.

Anaconda Copper Mining Co. Rebuilds Hastings Plant

The Anaconda Copper Mining Company, through its subsidiary, the American Brass Company, Waterbury, Conn., is rebuilding its electrical plant at Hastings-on-Hudson, a suburb of New York City. A testing laboratory for the advanced high tension cable work and for the examination of insulating oils, paper and cable sheath is being provided.

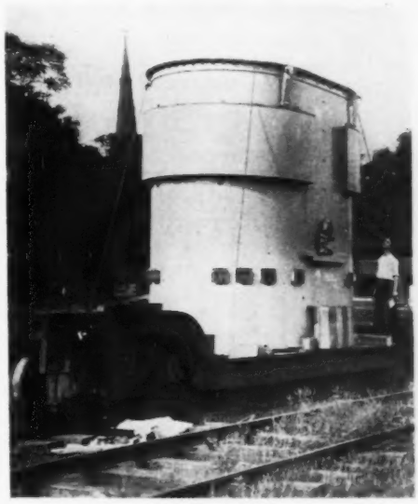
The Hastings plant is one of the largest copper cable mills in the country. The products run annually about 100,000,000 pounds. This figure includes other material as well as copper in the cable output.

Wagner Electric Announces New Branch Appointments

Wagner Electric Corporation, St. Louis, Mo., has appointed H. N. Felton, manager of the Milwaukee branch since 1927, as head of the New York branch of the company. Following his graduation from the University of Illinois in 1917, he spent two years in the army. He joined the Wagner organization as a salesman in the Chicago district.

Paul W. Forsyth, salesman for the Wagner Electric Corporation for the past 13 years, has been placed in charge of the company's Cincinnati office. He was graduated from Penn State College in 1912 and was connected with the J. G. White Company, New York, and the Detroit Edison Company before joining the Wagner force. F. T. Coup has been transferred from the Cincinnati office to the Milwaukee branch. He had been head of the Cincinnati branch since 1921.

A Transportation Problem



Special cars were built to carry two 75-ton transformers across level ground. Now the perplexing problem facing General Electric engineers is how to move them to their places atop a steep hill

Westinghouse Steel Mill Engineers Promoted

Changes involving the promotion of two steel mill engineers, both well known in the electrical and iron and steel industries, have been announced by the Westinghouse Electric and Manufacturing Company.

O. Needham, formerly section engineer in charge of steel mill engineering, has been appointed assistant superintendant of the testing department of the E. Pittsburgh works. He was a student in the Westinghouse apprentice course after he graduated from the Oklahoma Agricultural and Mechanical College in 1909. Since his connection with the general engineering department he has been concerned with the calculation of motor sizes and the application of electricity to steel mills.

William B. Shirk, who replaces Mr. Needham is a graduate of Lehigh University. His connection with Westinghouse dates from 1925, before which he had been identified with the Bethlehem Steel Company. He has played an important part in many industrial electrification projects.

Speeding Up Radio Receiver Production

The peak season in radio set production recently caused a rush order of radio parts to be shipped to the Philadelphia Storage Battery Company. To speed up the order, 251 pounds, 16 ounces of radio parts were packed in mail bags and sent out from the Milwaukee airport to Philadelphia. Above are shown the last few packs being loaded

Arthur Moss Is Elected Head of Electrad, Inc.

Arthur Moss, treasurer of Electrad, Inc., 173-175 Varick St., New York City, since the company was formed five years ago, has been elected president. He has also headed the company's sales and advertising departments.

Arthur Moss

Electrad, Inc., began manufacturing a wide range of radio parts at 428 Broadway, New York City. It remained at that address until the beginning of last year, when it moved to more spacious quarters at its present location. Under Mr. Moss' direction the company's sales have rapidly increased.

Buffalo Company Celebrates Fiftieth Anniversary

The Buffalo Forge Company, Buffalo, N. Y., engineers and manufacturers, is this year celebrating the fiftieth anniversary of its founding. The organization grew from an apparently hopeless enterprise in 1878 to its present prosperous position. W. F. Wendt, who joined the company a year after it was organized, guided it until his retirement in 1916.

In 1903 the company acquired the G. L. Squier Manufacturing Company and the Buffalo Steam Pump Company. Upon his retirement, Mr. Wendt sold his entire interest to his brother, H. W. Wendt, who still holds the position of president. The other officers are: E. F. Wendt, vice-president and treasurer, H. W. Wendt, Jr., vice-president and secretary, C. A. Booth, vice-president and sales manager, and H. S. Whiting, assistant secretary.

Canadian Westinghouse Names New Vice-Presidents

Announcement has been made of the appointment of H. U. Hart, as vice-president and chief engineer, and George R. Kerr, as vice-president and treasurer of the Canadian Westinghouse Company, Ltd. Both men have been identified with Westinghouse for over 25 years.

Mr. Hart enrolled in the student apprentice course at E. Pittsburgh, Pa., in 1893. Six years later he was sent to the French Westinghouse Company, as designing electrical engineer and later was appointed chief engineer. He joined the Canadian organization in 1905 as chief engineer, which position he has held for 23 years. In 1923 he was appointed general manager.

Mr. Kerr was one of the original members of the Westinghouse Manufacturing Company, Ltd., which was formed in 1903. He was then placed in charge of the accounting end of the business. He has always been associated with the financing of the organization and the rise to its present prosperous position has been in a large measure attributed to him.

Arc Welded Steel Building Shown in Motion Picture

The complete story of the application of arc welding in the fabrication and erection of the structural steel for the recently completed Upper Carnegie Building is portrayed in a motion picture produced by the Lincoln Electric Company, Cleveland, Ohio. The four story structure was designed exclusively for arc welding and contains many new features of construction, which have attracted marked attention from architects and engineers.

The picture opens with the fabricating of steel in the fabricating shop and continues as the work progresses to the completion of the building. An intimate study of the building design and methods of erection is thus afforded. The motion picture is offered gratis for showing, upon application to the Lincoln Electric Company.

Cutler-Hammer Co. Appoints Mortensen Chief Engineer

N. L. Mortensen, for the past five years assistant chief engineer of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has been appointed chief engineer, replacing T. E. Barnum, who was named consulting engineer.

N. L. Mortensen

Mr. Mortensen has been connected with the company for 21 years. He was born in Denmark, and received his education there and in Germany. He has frequently contributed articles to technical journals, and has delivered numerous papers before electrical societies. He is a member of the Association of Iron and Steel Electrical Engineers and is a fellow of the American Institute of Electrical Engineering.

Brevities

Rome Wire Company, a division of the General Cable Corporation, announces the opening of a new office in the Chamber of Commerce Building, Cincinnati, with K. D. Clothier, formerly at the Cleveland office, in charge. The company's Philadelphia office is now located at 123 S. Broad St., and the Detroit office at Room 1017, Fisher Building.

American Electric Switch Corporation, Minerva, Ohio, has placed a direct factory representative in the Metropolitan New York district, discontinuing the services of Holland and Monaghan, manufacturers' representative. The New York office and warehouse is located at 430 E. 53rd St. G. E. Lindstrom is manager.

H. P. Preis & Company, manufacturer of engraving machines and portable tools, formerly at 9-13 Campbell St., Newark, N. J., has moved to 227-229 Fulton St., New York City.

Timken Roller Bearing Company, Canton, Ohio, announces an expansion of production facilities which will raise the company's present output of 175,000 bearings a day to over 200,000 daily. An expenditure of about $6,000,000 will cover additions to both the steel mill and bearing factory.

Kempton Manufacturing Company, manufacturer of expansion bolts, formerly at 105 Barclay St., is now located at 148 W. 23rd St., New York City.

Manufacturers' Catalogs

Angle Steel Stool Company, Plainwell, Mich. Catalog C, illustrating and describing more than 250 patterns of modern, practical, steel-built equipment.

Stow Manufacturing Company, Binghamton, N. Y. Data sheets and illustrations, flexible shaft equipment and rotary motion machines.

L. H. Gilmer Company, Tacony, Philadelphia, Pa. Handbook, small belt drives, discussing use of belts of rubber and cord fabric for power transmission.

Holophane Company, Inc., 342 Madison Ave., New York City. Bulletin No. 448-A, industrial lighting specifics and their application.

Danly Machine Specialties, Inc., 2104 S. 52nd Ave., Chicago. Wall chart, for use by designers, tool room superintendents and die makers, showing flat, rounded and square, pressure-pad, stripper plate and knockout springs.

Westinghouse Electric and Manufacturing Company, E. Pittsburgh, Pa. Leaflet, L-20394, descriptive of Class 11-200 linestarters.

Personals

Charles S. Kenney, formerly distribution engineer, Brooklyn Edison Company, has joined the Rome Wire Company, division of the General Cable Corporation, where he will engage in engineering work in Metropolitan New York area.

Barney G. Tang, assistant general manager of the Schenectady Works of

the General Electric Company, has been appointed general superintendent to succeed James A. Smith, who died recently. Mr. Tang has been connected with the Schenectady Works since 1898 in the searchlight and switchboard departments.

A. S. Bissell, welding engineer for the Westinghouse Electric and Manufacturing Company, has resigned his position to enter the industrial field as an independent consultant in arc welding engineering on the Pacific Coast. He is a graduate of the University of Washington and has spent his entire career in the arc welding industry.

A. D. Cameron, for many years manager of the lighting division, General Electric Company, has been appointed Eastern sales manager of the Hurley Machine Company. He graduated from the Penn State School of Engineering in 1911 and shortly thereafter joined the street lighting department of General Electric. His headquarters will be at 147 W. 42nd St., New York City.

Obituary

Frederick Kent Copeland, president, Sullivan Machinery Company since 1892, died while on a visit to the company's Eastern works at Claremont, N. H., Nov. 10. After graduating from the Massachusetts Institute of Technology in 1876, he spent several years in diamond prospecting in Iowa and Colorado, helping to organize the Diamond Prospecting Company, which was merged with the Sullivan Machine Company in 1892. He was a member of numerous engineering societies.

Samuel G. Rhodes, general superintendent of the distribution and installation department, New York Edison Company, died suddenly at his home in Brooklyn, N. Y., Nov. 22. He had been associated with New York Edison since 1891, when he entered its employ as a wireman. In 1920 he was appointed assistant to the vice-president and the following year assumed the position he held at the time of his death. He had served on technical committees of the National Electric Light Association, American Institute of Electrical Engineers, and Illuminating Engineering Society.

Information Wanted

We have been asked for the names and addresses of manufacturers of the articles listed herewith.

Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of ELECTRICAL MANUFACTURING, 461 Eighth Ave., New York City.

"L. R. Co." Receptacles.
"Splendida" Electric Iron.
"Sal Co. 176" Lamps.
"Electron" Heating Pad.
"Lilly Wilson" Vacuum Cleaner.
"Perkins" Siren.
"Flint" Waffle Iron.
"Packard" Vacuum Cleaner.
"Blaisdell" Automatic Electric Cigar Lighter.
"Columbus-Universal" Electric Vacuum Cleaner and Floor Polisher.

Address of Dura Electric Appliances asked for in our November issue. This is a heating unit in a curling iron manufactured by the Samson Cutlery Co., Rochester, N. Y.

Address of Buckeye Instrument Co. (Manufacturers of Instruments.)

"Wharton" battery charger, asked for in our November issue. (Possibly "Wotten," manufactured by Electric Products Co., Clarkstone Road, Cleveland, Ohio.)

Coming Conventions

American Institute of Consulting Engineers—Annual meeting at New York City, Jan. 14, 1929.

American Institute of Electrical Engineers.—Annual winter convention at New York City, Jan. 28-Feb. 1, 1929.

American Washing Machine Manufacturers Association.—Annual meeting at Hotel Drake, Chicago, Ill., Jan. 18, 1929.

Artistic Lighting Equipment Association.—Annual meeting at Cavalier Hotel, Virginia Beach, Va., Feb. 5-7, 1929.

Midwest Power Conference and Exhibition.—Fourth show at the Coliseum, Chicago, Feb. 12-16, 1929.

New Goods for Your Inspection

Aluminum Solder

Aluminum Solder Corporation of America, 730 Fifth Avenue, New York, announces Soldalume, an aluminum solder. The manufacturer states, on the basis of tests conducted at Columbia University, that this solder is the first successful aluminum solder ever produced. According to these tests, butt joints of duraluminum to duraluminum are made with great success up to 30,000 lb. per sq. in. and butt joints of aluminum to aluminum with a tensile strength up to 12,000 lb. per sq. in. Soldalume is a white powder which solders at 350 deg. to 400 deg. Fahr. 850 deg. Fahr. is required to destroy the soldered joints. Besides the powder, three types of stick solder are made.

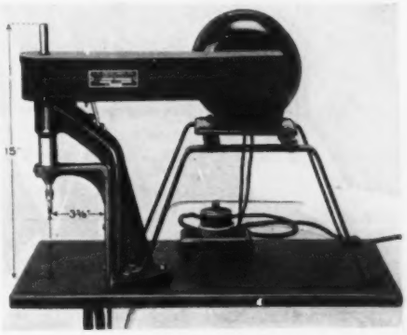
High Efficiency Motor

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has placed on the market Type AR high efficiency motor. This motor is of frameless construction, the feet being fastened to the end frames that are riveted to the laminated core. Through the elimination of the brush lifting device, the motor is designed to be as nearly foolproof as possible and exceptionally quiet

in operation. The lubrication system consists of a felt wick under the bearings, saturated with a generous supply of oil. Overhead oilers are provided for convenient replenishing of the oil. The manufacturer states that tests indicate that the motor can be operated for one year without replenishing the oil supply. The ball-type, short-circuiter is located on the end of the commutator. The rotors are dynamically balanced to eliminate vibration. A motor mounting designed for a given size at 60 cycles will also house the 50 and 25 cycle motors of the same rating without any change. This motor is available in 1/6, 1/4 and 1/3 hp. sizes.

Vim Electric Tools

Vim Tool Co., 149 Broadway, New York, are manufacturing a line of bench tools, for drilling, driving, screws, spinning eyelets in porcelain, buffing, grinding and polishing. It is operated by a foot pedal and intended for use by manufacturers of



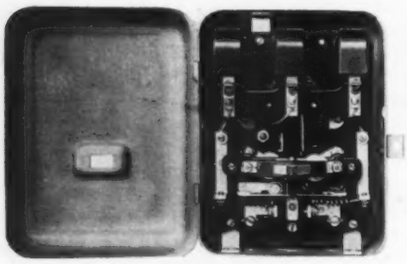
lamps, radios, conduit, electrical goods, electrical switchboards and other similar products. This machine will drive screws at 1000 r.p.m. All machines are ball bearing throughout. It is available in any current and voltage required.

Chromaloid

American Nickeloid Co., Peru, Ill., has introduced to the trade "Chromaloid," a metal which is said to have unusual corrosion resisting properties. It is asserted that this new metal will withstand all severe weather conditions, resist all alkali and virtually all acids. Chromaloid can be formed and bent, and will stand light drawing, it is stated. Chromaloid is now ready for fabrication by manufacturers in sheet form, the same as chromium plate. Chromaloid's alleged properties make polishing and refinishing unnecessary. Its discoverers contend that this metal is durable, rustproof and workable, besides being economical.

Magnetic Switch

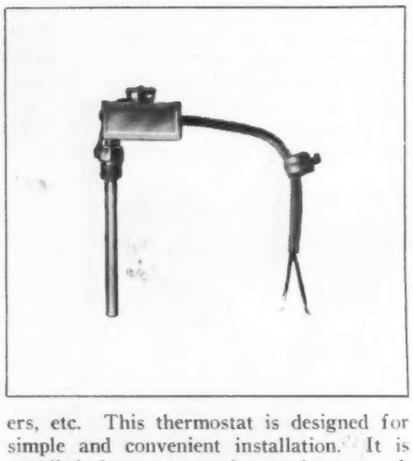
Diamond Elecl. Mfg. Co., 1318 E. 10th St., Los Angeles, announces the manufacture of a magnetic motor starting switch combining the features of roominess, ac-



cessibility and ease of installation. This starter has been designed to connect directly across-the-line in starting, and is adaptable to the control of single and polyphase squirrel-cage induction motors. The switch is just the size of a man's hand. It is provided for motors up to 7½ hp.

Immersion Thermostat

Struthers Dunn, Inc., 1130 Race St., Philadelphia, offers an immersion thermostat, for use in the control of temperatures of metal baths, oil tanks, water heat-



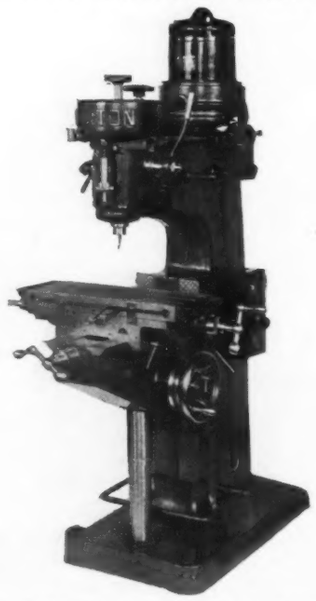
ers, etc. This thermostat is designed for simple and convenient installation. It is supplied for two or three wire control. Temperatures to 600 deg. Fahr. can be controlled, with an accuracy of 2 to 10 deg. depending on the location.

Esterline Angus Instruments

Esterline Angus Co., Indianapolis, Ind., announces ten improvements in its line of graphic instruments. The chart driving gears, which must be changed to permit different chart speeds, are now keyed to the shaft instead of being held by thumb screws. A drive roll that is free on the shaft to make adjustments easy is now incorporated in these instruments. This eliminates the necessity of loosening the driving gears to adjust the rolls. The roll is driven by a friction clutch. The chart was formerly carried on a roll supported on bearings at either end. It is now simply dropped in a carrier, which allows it to align itself accurately with the drive roll. The reroll bracket is made stronger and swings out of the way, so that it cannot become bent and out of line with the driving roll. The reroll has been improved for both single and twin type instruments. The usual slot in the reroll has been eliminated and a clip is provided at one end. The guide which guides the paper on the roll is now mounted on the side of the clock case instead of on the roll. A new handle for portable meters insures the case being held shut while the meter is being carried. A new ink, ink container and pen filler are now provided. The pen filler greatly facilitates servicing a large number of instruments or an instrument having several pens. An improved paper is used for the charts, which are printed and perforated on a special machine producing charts in two colors.

Milling and Routing Machine

George Gorton Machine Co., Racine, Wis., announces a vertical milling and routing machine. The machine is adapted for handling die and tool room work, and similar milling and routing in brass, steel and cast iron. It is designed to run small cutters at high speed. A feature of this machine is the sliding head, which carries the spindle and drive completely. The machine has a direct drive, with V belt from ¾ hp. standard, ball-bearing, vertical motor. Ten spindle speeds (475 to 3000 r.p.m.) are obtainable without back gears or changing pulleys. Higher speeds up to 6000 r.p.m. are available for brass routing and use with diamond tools. For brass routing this machine is also equipped with foot treadle to spindle feed, chip blower integral with motor, and a forming attachment for cutting curved surfaces. A spindle-pulley brake facilitates cutter changes. Feed screws are covered and ways are shielded. Large diameter graduated dials permit accurate adjustment of all feed screws to fractions of a thousandth. The spindle is completely inclosed, ball bearing, and running in oil. It is machined from a solid bar of chrome man-



ganese alloy steel, hardened, and ground inside and out, with splined drive. The spindle is mounted in a sleeve machined from a solid billet of the same material, hardened and ground inside and out, and sliding in a hardened, ground steel bushing. The height over all is 68 in. and its weight is 1600 lb.

Push Type Binding Post

J. L. Polk, 3 Lakewood Place, Troy, N. Y., has brought out a push type binding post that eliminates the necessity of inserting a wire in the post. A cap having a knurled edge is fastened to the top of the post, and the movable portion of the device slides up and down on the shaft. The wire to be connected to the post is simply looped around the shaft under the cap and the movable portion holds it firmly in the grooves of the knurling.

Safety Limit Stop

Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio, offers the trade a safety limit stop for cranes with AC or DC motors. In case the crane hook over-travels, the safety limit stop not only cuts off power from the crane motor but also brings the hook to a quick stop with-

out drifting. DC stops accomplish quick stopping by dynamic braking, and AC stops by plugging. After such stop the hook can be lowered by reversing the controller, the limit stop automatically resetting itself. This stop is operated directly by the hook block.

Burtex Cone Material

Stevens Mfg. Co., 46 E. Houston St., New York, is marketing Burtex, a cone material which is designed to be superior to paper in the manufacture of cones for loud speakers. Burtex is a thin fabric from which cones are formed in a single piece under pressure and then impregnated with a waterproofing compound which is said to possess valuable acoustic properties. A second variety of this material, adaptable for use in light, non-resonant exponential horns is also available.

For new growlers, test stands, test benches, tachometers and other equipment used in the testing of motors and generators see the Encyclopedia of Tools and Equipment for Manufacturing and Repairing—Part 2 beginning on the following page.

Encyclopedia of Tools and Equipment for Manufacturing and Repairing—Part 2

This comprehensive pictorial Encyclopedia of Tools and Equipment for Manufacturing and Repairing is the first to be compiled and gives the latest available information, specifications, illustrations and list prices for all types of armature and coil making and repairing devices and other special machines and tools used in the manufacture and repairing of motors and generators and transformers. This material is published in two sections as follows:

Part 1—published in November:

Undercutting machines, commutator surfacing machines and tools, coil winding machines, blowers, sprayers, ovens, dipping tanks, impregnating equipment, jacks, hoists and lifts, pulley gear and pinion pullers and other equipment.

Part 2—in this issue:

Armature growlers, test stands, test benches, meters, trouble shooters, fault finders, tachometers, insulation testers, etc.

Wherever possible an illustration is included for each type of device listed and every effort has been made to secure the character of information most useful to the manufacturer and rebuilder.

A complete up-to-date and revised list of all manufacturers appears in the Classified Index of Raw Materials, Parts and Electrical Equipment which is a regular monthly feature of ELECTRICAL MANUFACTURING.

Allen Electric & Equipment Co.,

Kalamazoo, Mich.

Armature Growlers

Catalog Nos. A-30, A-31, A-32, A-33

Trade Name—"Allen"; **Use**—To locate short or open circuits and grounds in generator and starting motor armatures; **Description**—(A 30) equipped with 2 test points, cord and plug; fields of laminated steel, mounted on cast iron base; (A-31) unit only with switch, no base; (A-32) equipped with test lamp and leads; meter with external zero adjustment; meter current controlled by adjustable rheostat to compensate for different kinds of armatures; contact arms are adjustable for any commutator or they may be detached for hand operating; (A-33) steel fields mounted on cast iron base; cord and plug; **Dimensions**—7¾ x 6¾ x 10 in.; 4⅞ x 6 x 5 in.; 11¼ x 7½ x 15 in.; 4⅛ x 3 x 3¼ in.; **Weight**—9 to 29 lbs.; **List Price**—$15.00-$12.50-$39.00-$8.50 (No. A-30 illustrated); **Special Features**—(A-30 and A-32) light in base prevents growler from being burned out.

Note: Armature test meter A-63 can be used with growler A-30, A-31 or A-33. It locates trouble in rewound or reconnected armatures without an A. C. meter and the growler bar to bar test; weighs 4 lbs.; $18.50, including contact leads.

Trouble Shooter

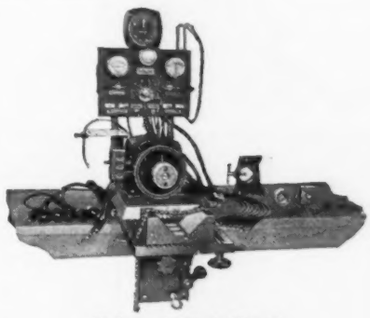
Catalog No. E-105

Trade Name—"Allen"; **Use**—For testing generators and starting motors; **Description**—Portable outfit equipped with 2 test prods, 2 battery clips, a triple scale ammeter, a quadruple scale voltmeter, double throw switch and a rheostat; friction hinge permits upper part of tester to be tilted so that readings can be easily observed; carrying handle at top; clamps are provided for wall mounting; **Dimensions**—14 x 6½ x 12 in. high; **Weight**—30 lbs. (shipping); **List Price**—$42.50.

Universal Test Stand

Catalog No. E-64

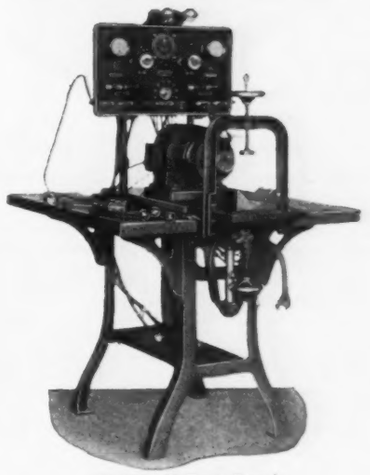
Trade Name—"Allen"; **Use**—For testing armatures and coils; **Description**—Panel board mounted above motor is equipped with 2 meters, test lamp, 2 test points, condenser, battery switches and spark gap; speed control handle on top of motor, power switch and cutout test clamp on side; adjustable V blocks; for 110 to 220 volts, 60 cycle A. C.; **Motor** (Hp.)—½; **Dimensions**—22 x 11 x 16⅛ in. high; **Weight**—150 lbs.; **List Price**—$120.00; $15.00 extra for 25 cycle; $35.00 additional for tachometer or speed indicator.



Universal Test Stand

Catalog No. E-74

Trade Name—"Allen"; **Use**—Generator testing; **Description**—Bakelite panel mounted above motor, equipped with meters, switches, test light and two 110 volt test prods; chain clamp for holding generators, double range 30-030, 600-0-600 ammeter, compression coupling; **Motor** (Hp.)—½, straight line drive; **Dimensions**—28 x 11 x 24 in. high; **Weight**—200 lbs.; **List Price**—$165.00; additionals, $30.00 for tachometer; $30.00 for 1 hp. motor; $15.00 for 25 cycle.



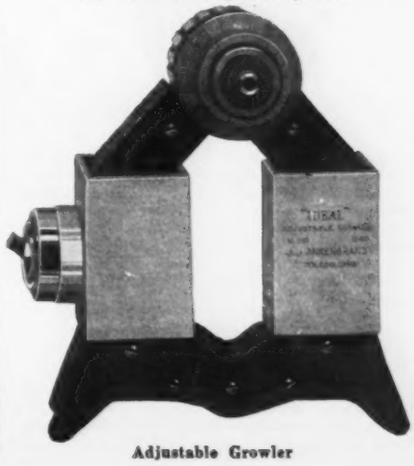
Universal Test Stand

Catalog No. E-76

Trade Name—"Allen"; **Use**—Armature testing; **Description**—Mounted on wooden top bench with iron legs, wooden shelf below; tachometer 300-3600 r.p.m.; 110 volt test lamp and panel light; 0-20 voltmeter; combined 30-0-30 and 600-0-600 ampere ammeter; 8 point multiple spark gap; independent voltmeter test jack; 6 and 12 volt cutouts protect meters, mounted on Bakelite panel board; variable speed motor, either direction; rotary spark gap; clamp plate; test leads; V block; elevating table; **Motor** (Hp.)—1; **Dimensions**—48 x 38½ x 64 in. high; **Weight**—686 lbs.; **List Price**—$375.00.

J. J. Ankenbrandt,

2140 Wakeman St., Toledo, Ohio



Adjustable Growler

Trade Name—"Ideal"; **Use**—For testing armatures; **Description**—Hinged at the base, adjustable to fit various sizes of armatures; windings inclosed in a metal case; wound for 60 cycle 110 volts; **Dimensions**—Made in 5 sizes, (face) 2, 3½, 5, 7 and 10 in.; **List Price**—$15.00, $25.00, $35.00, $50.00, $65.00 (additional cost for meters); **Special Features**—Makes magnetic contact at armatures where needed without any overhanging or protruding iron; equipped with toggle control switch.

James G. Biddle,

1211 Arch St., Philadelphia, Pa.

Insulation Test Set

Trade Name—"Megger"; **Use**—Testing insulation and measuring high resistance; **Description**—Portable device mounted in teakwood case with removable handle; D. C. hand-driven generator; moving coil type, direct reading, ohmmeter registers test; **Ranges**—As high as 10,000 megohms and as low as 5 ohms; **Weight**—21 lbs.; **List Price**—Not stated.

"Meg and Super Meg," test sets, operate on same principle as the "Megger" with the exception that they are smaller and are adapted to different testing ranges. Mounted in aluminum cases with metal handles and lid for scale protection.

Ranges—Up to 100 megohms only; **Dimensions**—(Meg) 5½ x 7¾ x 6¼ in. high; (Super Meg) 5½ x 8⅝ x 6¼ in. high; **Weight**—(Meg) 6¾ lbs.; (Super Meg) 7¼ lbs.; **Price**—Not stated.

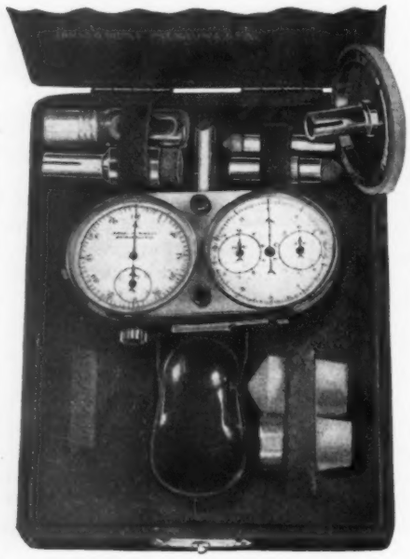
Type C Hand Tachometer

Trade Name—"Jagabi"; **Use**—Motor and generator r.p.m. measurements; **Description**—Centrifugal type mounted in case; speed indicated by pointer as soon as the spindle is placed in the end of shaft under test; **Dimensions**—(dial) 3 in. dia.; (scale) over 6 in. long; **List Price**—$40.00-$60.00-$70.00, respectively, for single, 3 and 4 ranges (including case and accessories).

Hand Tachoscope

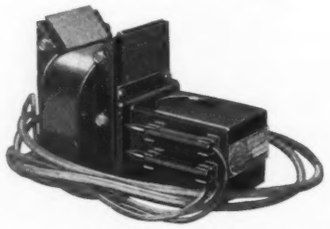
Catalog No. 900

Trade Name—"Jagabi"; **Use**—Testing speed; **Description**—Mounted in case, consisting of stop watch and revolution counter which are combined so that they operate simultaneously upon pressing a lever on the instrument while the spindle is engaged with the shaft under test; speed is calculated from the two readings; suitable for checking indicating tachometers; **List Price**—$70.00, including case and accessories.



Burton & Rogers Mfg. Co.,

857 Boylston St., Boston, Mass.



Model GB Growler

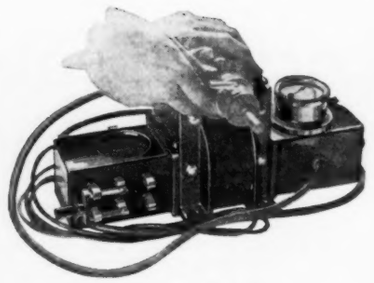
Same as GA except that meter, rheostat and contactor have been omitted. A hacksaw blade or piece of thin steel is used to detect armature trouble; **Dimensions**—10 x 6 x 6½ in. high; **Weight**—18½ lbs.; **List Price**—$22.50.

Model No. GC Growler

Same as Model GA except that it is a plain growler and is not equipped with test lamps, prods, meter and rheostat; **Dimensions**—5 x 6 x 6¼ in. high; **Weight**—15 lbs.; **List Price**—$18.50.

Model No. GD Growler

Description—Single winding for testing generator armature only; **Dimensions**—4½ x 6 x 6½ in high; **Weight**—12 lbs.; **List Price**—$12.50.



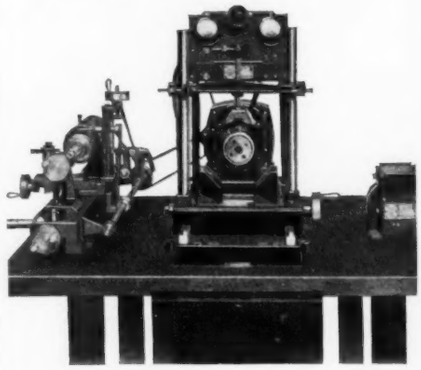
Model GA Growler

Trade Name—"B & R"; **Use**—For testing any type of armature in either generators or starting motors; **Description**—Finished in maroon and black with nickel trim and equipped with ground test-light and prods, calibrated A. C. meter, double winding for series or parallel operation, controlled by rheostat, and D.P.D.T. switch; **Dimensions**—15 x 6 x 6½ in. high; **Weight**—22 lbs.; **List Price**—$38.00 (including 6 ft. rubber covered lead and separable plug).

Armature Test Bench

Model TAB

Trade Name—"B & R"; **Use**—For testing armatures; **Description**—Oak top, angle iron legs, steel draw and a shelf below for battery space, equipped with a complete testing unit (Model TA), consisting of a 1 hp. driving motor, unit locking single adjustment vise, panel control board with meters mounted above motor, flexible test leads; also equipped with Model GA Growler and an undercutting machine; **List Price**—$466.00 complete (Test unit $282.00; undercutter $96.00; GA Growler $38.00; bench $50.00; can be bought separately).



Armature Test Bench

Model TBB

Trade Name—"B & R"; **Use**—For testing armatures; **Description**—Oak top, equipped with Model TB test unit consisting of ½ hp. motor with panel mounted directly above supporting all meters and switches; panel light illuminates entire bench; GD Growler and undercutting machine; **List Price**—$333.50 complete (Test unit $175.00; undercutting machine $96.00; growler $12.50; bench $50.00; parts can be bought separately).

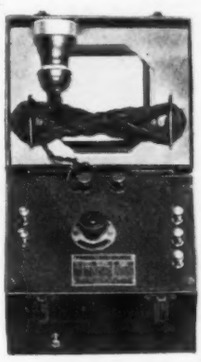
Century Electrical Co.,

100 Randall Ave., Syracuse, N. Y.

Trade Name—"Century"; **Use**—For testing the field coils and armatures of direct current types of motors and generators; **Description**—Equipped with a loud speaking receiver, testing fork and ground detector, also a search lamp; the fork is made for bar-to-bar testing; it is inclosed in a steel case, with black Japan finish; operated from direct current source; **List Price**—$80.00; $5.00 additional for quartered oak case; **Special Features**—Field coils can easily be tested while in position in the pole

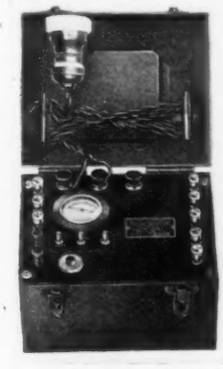
Field Coil Tester

pieces as well as when out of the motor; armatures can be tested without unsoldering any lead wires from the commutator or disturbing the hoods.



Armature Tester

Trade Name—"Century"; **Use**—For detecting short and open circuits, wrong connections and grounds in armatures without unsoldering any lead wires from the commutator or disturbing the hoods; operated from either A. C. or D. C. supply; **Description**—Black Japanese steel case equipped with two testing forks; receiver type fork can be used with either A. C. or D. C., while the meter type is only used with A. C.; the forks are for bar to-bar testing; the small trouble search lamp can easily be inserted down behind commutators or into small spaces between windings; **List Price**—$40.00 to $50.00; $5.00 additional for quartered oak case; $2.25 additional for search lamp.

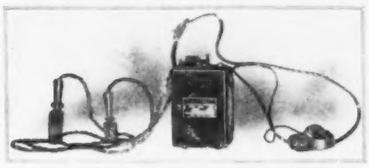


Field and Armature Coil Tester

Trade Name—"Century"; **Use**—For testing the field and armatures of direct current types of motors and generators; **Description**—Provided with both receiver and meter types of testing forks, contact points and ground detector, also a trouble search lamp; receiver type fork is fitted with loud speaking receiver; the meter type fork has a large scale deflection and an adjustment for limiting the movement of the needle or pointer. The forks are made for bar-to-bar testing; this is all inclosed in a steel case with black Japan finish; operated from alternating current circuits; **Weight**—About 15 lbs.; **List Price**—$80.00 to $95.00 (110-220-440-660 volts, 60 cycles); $5.00 additional for quartered oak case.

Electric Controller & Mfg. Co.,

2700 E. 79th St., Cleveland, Ohio



Armature Fault Finder

Trade Name—"E. C. & M."; **Use**—For locating and detecting motor armature troubles, open and short circuits, etc.; **Description**—Telephone head set, two testing points, used in place of a magneto; signal is indicated by a buzzer; **List Price**—$48.00.

Fidelity Electric Co.,

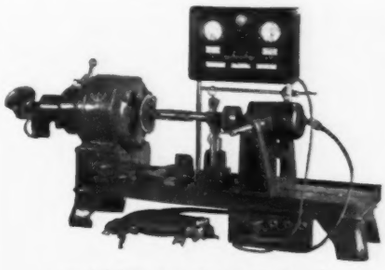
Lancaster, Pa.

Micro Fault Finder

Trade Name—"Fidelity"; **Use**—New testing device for locating troubles in motor circuits; **Description**—Receiver and U-shaped tester. In operation the U-shaped piece is placed over one conductor at a time and conditions determined by the volume of sound in the receiver. Absence of sound indicates an open circuit. Single phasing, unbalanced phases, open parallels, grounds and shorts may be located; **List Price**—$8.00.

Hobart Bros. Co.,

Troy, Ohio



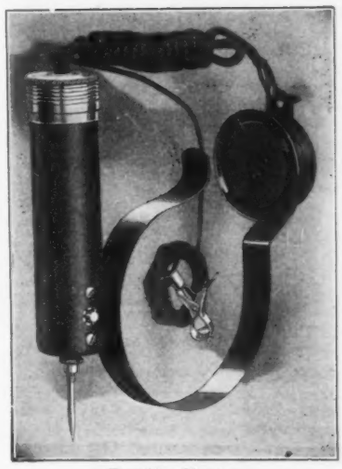
Model HB Armature Test Bench

Trade Name—"Hobart"; **Use**—For testing armatures; **Description**—Iron base; tachometer attached to end of motor; ammeter and voltmeter mounted on instrument board, also no-glare test lamp, 110 volts with ground lens; 1½ hp. reversible, variable speed motor, self-aligning coupling, vise holds all sizes of generators, complete torque test equipment furnished, spark gap for testing ignition outfits; **Dimensions**—49 x 15 x 28 in. high; **Weight**—375 lbs.; **List Price**—$275.00 A. C.; $295.00 D. C. ($30.00 additional for steel testing table; $75.00 for lathe attachment).

Leich Electric Co.,

Genoa, Ill.

Trade Name—"Scout"; **Use**—Testing armatures; **Description**—Consists of a receiver and head band, also a hand piece with a small standard flash light battery, push button switch and attached to one end is a reversible, blunt or sharp, exploring point; **List Price**—$4.00 com-

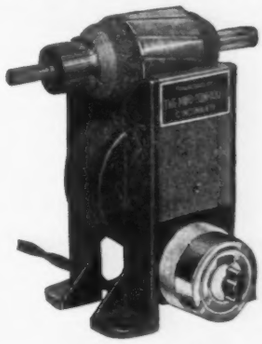


Trouble Shooter

plete with battery; **Special Features**—Also used for testing fuses, lamps, wiring opens, shorts, fixtures, soldering irons, switch contacts, condensers, generators, cutouts, switchboard grounds, etc.

Miho Company,

717 Sycamore St., Cincinnati, Ohio

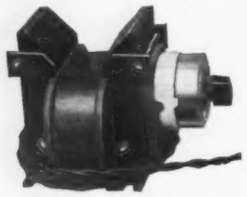


Universal Growler

Use—For locating trouble in armatures of motors or generators; **Description**—Equipped with a special winding of sufficiently large wire to give satisfactory and accurate readings on small motor armatures of all types of windings; is especially adapted for locating faults in appliance motor armatures; short circuited, open circuited or grounded coils can be quickly and accurately located; has indicating snap switch mounted on the base; **Weight**—21 lbs. (shipping); **List Price**—$16.00.

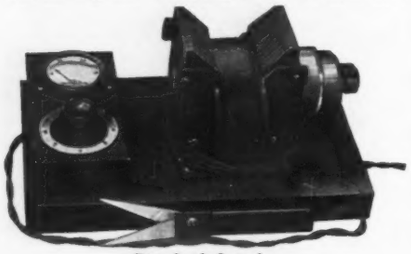
Master Growler

Trade Name—"Miho"; **Use**—For locating armature trouble in motors or generators; **Description**—Equipped with meter and armature aligner that holds each coil in the same position which is necessary for meter registration; snap switch controls winding; **Weight**—30 lbs. (shipping); **List Price**—$35.00.



Utility Growler

Use—For locating faults in generator and starting motor armatures; **Description**—Equipped with snap switch, leads and attachment plug for connection to A. C. source; **Weight**—7½ lbs. (shipping); **List Price**—$7.50.

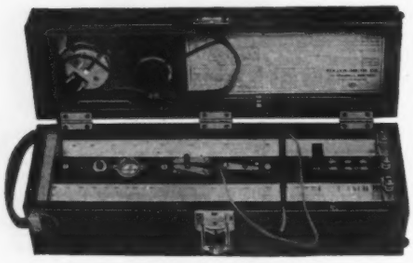


Standard Growler

Same as "Utility" except that it is equipped with a meter and shear like tester; **Weight**—11 lbs. (shipping); **List Price**—$17.50.

Roller-Smith Co.,

233 Broadway, New York, N. Y.



GOM Ohmmeter
Catalog Nos. 3002-3003

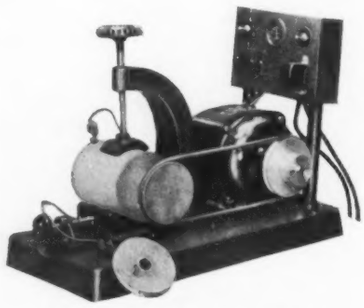
Trade Name—"Roller-Smith"; **Use**—For testing armatures and coils; **Description**—Hardwood case with nickel trim, hinged top, latch and lock, leather handle, rubber feet at bottom and at one end. Equipped with receiver and head band, two flash light batteries and a test lead. Portable, direct reading slide wire type. Operating directions on card inside cover of case. Multiscale instruments are used; **Dimensions**—17 x 5 x 5 in. high; **Weight**—22 lbs. (shipping); **List Price**—$120.00 and $130.00. (Nos. 1006 and 1030, 13 lbs., $90.00).

Servwell Sales Corp.,

1749 N. Winchester Ave., Chicago, Ill.

Servwell Growler

Use—For locating faults in the starting motor or generator armatures, external shunt field or brushes; **Description**—Equipped with two test leads, lamp and attachment plug; operates on 110 volt A. C.; **List Price**—$15.00 complete ($12.50 for unit alone).



Junior Armature Test Bench

Trade Name—"Servwell"; **Use**—For testing armatures, field windings and brush ring assembly; **Description**—Heavy malleable base test stand with adjustable vise, motor, driving pulleys, belt, two test prods, light and instrument panel, mounted on steel bench having sliding tool drawer and shelf below for storing generators and batteries; **List Price**—$176.00 complete.

Herman H. Sticht & Co.,

15 Park Row, New York, N. Y.

Catalog No. 11560

Trade Name—"2 in 1-Megohmer"; **Use**—For insulation resistance measurements on motors and generators as also wiring cables, etc.; **Description**—Consists of an ohmmeter with two ranges, 0-100 megohms and 0-5000 ohms; self-contained hand operated direct current generator furnishes 500 volts; voltmeter with two ranges, 0-240 and 0-480 volts A. C. and D. C. provides a means of measuring the voltage generated, also may be used as a portable voltmeter; **Dimensions**—9¼ x 6½ x 9½ in. high; **Weight**—18¼ lbs.; **List Price**—$250.00.

Catalog No. 1431

Trade Name—"Standco Ohmmeter"; **Use**—For resistance measurements of coils, circuits or any other resistances of 2000 ohms or less; **Description**—Consists of a special ohmmeter system with self-contained dry cell battery; magnetic shunt provided with a check key permits correcting for drop in voltage of the dry cells due to use or deterioration; wide open scale at the lower end of the range and slightly compressed at the upper end assures accuracy throughout the range of the instrument; **Ranges**—0-20, 0-200 and 0-2000 ohms; made with other ranges too; lowest range instrument has two ranges, 0-1.5 and 0-7.5 ohms; **Dimensions**—9½ x 6¼ x 5¼ in. high; **Weight**—7½ lbs.; **List Price**—$104.00.

Catalog No. 2252

Trade Name—"Standco Tachometer"; **Use**—Measuring the revolutions per minute of motors, generators and other rotating machines; **Description**—Pocket size; centrifugal type; has two small weights that are thrown apart by centrifugal force when the instrument is applied to the shaft. The faster they are rotated, the further these weights travel. A link motion is provided that translates this travel to the pointer which travels over a scale and reads directly in revolutions per minute without the need of a stop watch and without any calculations; **Ranges**—60/240, 200/800, 600/2400 and 2000/8000 R.P.M.; **Dimensions**—3⅛ x 3⅛ x ⅝ in. high.; **Weight**—10 ounces; **List Price**—$62.50; **Special Features**—A pointer locking device that permits of arresting the pointer before removing the instrument from the end of the shaft; pressing the pointer resets the instrument to zero; a rubber tired wheel of 3 inches circumference permits of using the instrument for surface speed measurements.

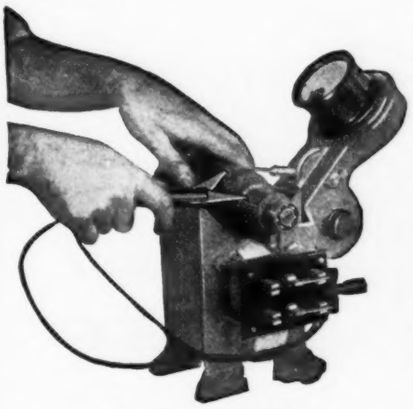
Joseph Weidenhoff, Inc.,

4352 W. Roosevelt Rd., Chicago, Ill.

Economy Growler

Trade Name—"Weidenhoff"; **Use**—Testing armatures; **Description**—Pole pieces of thin sheets of electrical steel with the contact faces

ground true and smooth coil, well insulated and protected by the frame; **Weight**—15 lbs. (shipping); **List Price**—$12.50 (Columbia Growler, 6 lbs., $16.50).



Armature Test-O-Meter

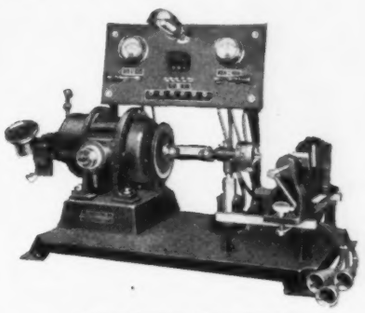
Trade Name—"Weidenhoff"; **Use**—Testing starting motor and generator armatures, also field coils; **Description**—Steel pole pieces with two coil winding; alligator contact testing fingers; meter; controlled by knife switch; as the testing points are applied to the commutator bars, the faults are indicated on the meter dial; **List Price**—$39.50.

Duplex Growler

Trade Name—"Weidenhoff"; **Use**—For testing starting motors and generator armatures; **Description**—Two coil winding series paralleled to switch; pole pieces laminated with faces ground true; draws ¾ amperes in low position and 3 amperes in high; **Weight**—37 lbs. (shipping); **List Price**—$25.00 ($16.50 additional for meter and pivoted contact finger testers).

Ultra-Service Test Bench
Model No. 25

Trade Name—"Weidenhoff"; **Use**—For testing bus type generators; **Description**—Nine ply veneer top with cast iron legs and tool tray; driving motor with self-aligning flexible coupling, 0 to 3600 r.p.m. either direction, 2 hp. rating; tachometer, speed control and reverse lever on end of motor; meters, switches and test lamp mounted on panel board, also spark gap assembly with 6 adjustable test points; **Dimensions** (Overall)—40 x 28 x 69 in. high; height of stand, 37½ in.; **Weight**—575 lbs. (shipping); **List Price**—$465.00 for 110 or 220 volts, 60 cycle A. C.; lathe and undercutter for bench mounting may be purchased with bench or separately; **Special Features**—Generators can be inspected and adjusted without removing coil, cutout or distributor.



Super-Service Test Bench
Model No. 18

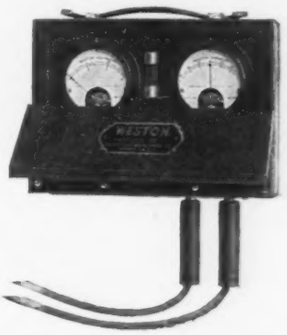
Trade Name—"Weidenhoff"; **Use**—For testing armatures; **Description**—Cast iron base, reversible motor, 0 to 3600 r.p.m. with tachometer mounted on shaft; three-jaw chuck mounted to flexible coupling, rotates in floating ball bearings; instrument board mounted above motor, equipped with a 30-0-30 and 300-0-300 ammeter, 0-25 voltmeter, switches, rotary gap and lamp; **List Price**—$285.00; **Special Feature**—Link is hardened and ground, operating on bronze rollers.

Utility Test Bench
Model No. 10

Trade Name—"Weidenhoff"; **Use**—For testing armatures; **Description**—Cast iron base, adjustable holding vise and distributor fixture, ignition synchronizer and standard breaker assembly with condenser; motor, ½ hp. with 3000 r.p.m. variable speed; instrument board mounted above motor, equipped with a 30-0-30 ammeter, an 0-25 voltmeter, switches and test lamp; **List Price**—$159.00 for 110 or 220 volts, 60 cycle A. C.; **Special Features**—Through flexible coupling, driving clamp attaches to generator shaft or over gear.

Weston Electrical Instrument Corp.,

Newark N. J.



Catalog No. 441

Armature Fault Finder

Trade Name—"Weston"; **Use**—For testing motor and generator armatures; **Description**—Consists of an ammeter and voltmeter mounted in a box with a carrying strap; 2 flexible rubber-covered cables having lead-covered universal clips on one end and plugs for connecting to the instrument on the other end. The ammeter has a range of 30-0-30 amperes. It is protected against accidental burn-out by a replaceable glass-enclosed fuse conveniently mounted on the case between the two instruments. The voltmeter has ranges of 2-0-30 and 0.2-0-3 volts. The latter range is particularly adapted to making cadmium tests; **List Price**—$31.00 ($2.75 additional for cadmium test cable), stock prices only.

A 1588 Page

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Note: The Classified Index of ELECTRICAL MANUFACTURING is limited to those subjects of interest to the specific field which it covers, for obvious reasons. A complete Classified Index of all electrical commodities bought, sold, or used by Electrical Supply Jobbers, Contractors, Dealers, Central Stations and other electrical industry outlets appears regularly in each issue of ELECTRICAL RECORD as heretofore. This Classified Index has been an exclusive ELECTRICAL RECORD feature for over thirty-six years.

ALUMINUM
(Also Aluminum Bronze Powder.)
Albron, Alcoa, Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh.
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Banding Machines. See Banding Machines, Armature
Bearings. See Bearings.
Buggies. See Lifts, Armature.
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Yarn and Thread. See Yarn and Thread.

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Johns-Manville Corp. (Elec'l Dept.) New York, N. Y.

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Anderson Bros. Mfg. Co., Rockford, Ill. (Ways).
Armature Coil Equip. Co., 2415 Forestdale Ave., Cleveland, O. (Machine).
Bowsher Co., N. P., South Bend, Ind.
Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. (Machines).
Sundstrand Machine Tool Co., Rockford, Ill.
Vibration Specialty Co., 1534 Winter, Philadelphia, Pa. (Machines).
BALL BEARINGS. See Bearings, Ball and Roller.

BANDING MACHINES, Armature
Columbia Machine Wks. & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
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American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Buckeye Tempered Copper & Brass Co., Mansfield, O.
Cameron Electric Mfg. Co., Ansonia, Conn.
Commutator Co., 121 N. Front, Minneapolis, Minn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., 4743 Hough Ave., N. E., Cleveland.
Home Brass & Copper Co., Rome, N. Y.
BASES, Radio Tube. See Radio Molded Parts.

BASES, Reading Lamp
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American Ring Co., Waterbury, Conn.
Aladdin Mfg. Co., Sales Div. No. 802, Muncie, Ind.
Armor Bronze Co., Garwood, N. J.
Camden Art Tile & Pottery Co., Camden, Ark.
Colonial. See Old Colony Iron Wks.

Estes & Sons, E. B., 5844 Grand Central Terminal, New
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Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sneath Glass Co., Hartford City, Ind.
Van Briggle Tile & Pottery Co., Colorado Springs, Colo.
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Yokel Corp., 219 Homestead Ave., Hartford, Conn.
Zane Pottery Co., South Zanesville, O.
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Dunco. See Struthers Dunn, Inc.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.

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Bantam Ball Bearing Co., South Bend, Ind.
Braun Bearings Co., Primos, Pa.
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Hyatt Roller Bearing Co., Newark, N. J.
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Marlin-Rockwell Corp., Jamestown, N. Y.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
New Departure Mfg. Co., Bristol, Conn.
Nice Ball Bearing Co. (Nicetown), Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
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Schatz Mfg. Co., Poughkeepsie, N. Y.
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Standard Steel & Bearings, Inc., Plainville, Conn.
Strom Bearings Co., 4587 Palmer, Chicago, Ill.
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Torrington Co., Torrington, Conn.

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Bogert & Hopper, Inc., 225 Varick, New York, N. Y.
Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Burlington Metal Corp., Burlington, Wis.
Cleveland Graphite Bronze Co., 880 E. 72nd, Cleveland, O.
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Lubrite. See Merriam Bros., Yonkers, N. Y.
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O. & S. Bearing Co., 315 S. Artillery, Detroit, Mich.
Reliance. See Metal Saw & Machine Co.
Seib Lignum-Vitae Woodturning Co., 98 Boyd Ave., Jersey City, N. J.
United States Graphite Bearing Co., Saginaw, Mich

BEARINGS AND BUSHINGS
(For Armature Shafts.)
Ajax Metal Co., Philadelphia, Pa.
American Bronze Corp., Berwyn, Pa.
Bunting Brass & Bronze Co., Toledo, Ohio.
Damascus Bronze Co., Pittsburgh, Pa.
Durex. See Moraine Products Co.
Flood City Mfg. Co., Johnstown, Pa.
Johnson Bronze Co., New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.
Moraine Products Co., Dayton, O.
National Bearing Metal Corp. (More-Jones Brass & Metal Div.), 4930 Manchester Ave., St. Louis, Mo.
United States Graphite Co., Saginaw, Mich.
BELTING, Chain Transmission. See Chain, Power Transmission.

BELTS, Rubber
Molded Cord Rubber Belts for Electrical Appliances.
Fay Rubber Products Co., Elyria, O.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.

BENDERS, Coil Loop
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

BENDING. See Punching & Bending.
BINDING POSTS. See Posts, Binding.

BLADES, Fan
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y.
Torrington Mfg. Co., Torrington, Conn.
BLUESTONE. See Chemicals, Battery.
BOARD, Fuller. See Cloth and Paper.
BOARD, Press. See Cloth and Paper.
BOWL HOLDERS. See Fixture Fittings.

BOX BOARD
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Mid-West Box Co., Dept. 36, 111 W. Washington, Chicago

BOXES, Fibre
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Corrfibre. See Container Corp. of America.
Mid-West Box Co., Dept. 36, 111 W. Washington, Chicago.
BOXES, Sheet Steel. See Cabinets, Sheet Steel.
BOXES, Wood. See Cabinets & Boxes, Wood.

BOXES AND WRAPPERS
Brown & Bailey Co., Front & Willow Sts., Philadelphia, Pa.
Bulldog. See Pittsburgh Corrugated Paper Box Co.
Campbell Paper Box Co., South Bend, Ind.
Consolidated Paper Co., Monroe, Mich.
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Gair Co., Robert, 420 Lexington Ave., New York. (Boxes.)
Gator-Hide Kraft. See International Paper Co.
Hinde & Dauch Paper Co., 304 Decatur, Sandusky, Ohio.
International Paper Co., 100 E. 42nd, New York, N. Y.
Lake Lithographing Co., 2570 Superior Ave., Cleveland, O. (Display Cartons.)
Mid-West Box Co., 111 W. Washington, Dept. 36, Chicago
National Folding Box Co., New Haven, Conn. (Cartons.)
Pittsburgh Corrugated Paper Box Co., Pittsburgh, Pa.
River Raisin Paper Co., Monroe, Mich.
Sefton Mfg. Co., 59 E. Madison, Chicago, Ill.
Shuttleworth Carton Co., 474 W. Broadway, New York.
BRAIDING MACHINES. See Wire Manufacturing Machines.
BRASS TUBING. See Tubing, Brass and Copper.

BRASS, BRONZE AND COPPER
Sheet, Rod, Bar.
American Brass Co., 25 Broadway, New York, N. Y.
American Nickeloid Co., Peru, Ind.
Anaconda. See American Brass Co.
Baltimore Brass Co., 1212 Wicomico, Baltimore, Md.
Baltimore Copper Mills, (Div. of General Cable Corp.), Baltimore, Md.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Dallas Brass & Copper Co., 812 Orleans, Chicago, Ill.
Nickeloid. See American Nickeloid Co.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa. (Rods and Forgings.)
BREAKERS, Circuit. See Circuit Breakers.
BRIDGES, Wheatstone. See Instruments, Laboratory Standard.
BRONZE. See Brass, Bronze and Copper; also Castings.
BRONZE, Phosphor. See Phosphor Bronze.
BRONZE POWDER, Aluminum. See Aluminum.
BRUSH HOLDERS. See Brushes, Commutator.
BRUSHES, Carbon. See Brushes, Commutator.
Graphite. See Brushes, Commutator.
Metal Graphite. See Brushes, Commutator.

BRUSHES, COMMUTATOR
(Brushes, Brush Holders and Flexible Leads.)
Brush Holders ..... See H
Carbon, Graphite, Metal Graphite ..... See C
Flexible Leads and Pig Tails ..... See L
Sheet Metal ..... See S
Wire Gauze ..... See W
Automotive Mfg. Co., Kansas City, Mo. ..... H
B. B. B. See Becker Bros. Elec'l Corp.
Baylis Co., Bloomfield, N. J. ..... H
Becker Bros. Elec. Corp., 23 N. Jefferson, Chicago, Ill. ..... C W S H L
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y. C
Boxill-Bruel Carbon Co., Columbia Park, O. C ..... H
Burrows & Co., 1135 W. Van Buren, Chicago, Ill. C
Calebaugh Self-Lubricating Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. C
Carbon Engrg. Co., Slinger, Wis. ..... C L
Carbon Laboratories Co., 5005 Euclid Ave., Cleveland, O. C
Carbon & Graphite Corp., 227 West Broadway, New York, N. Y. C
Carenco. See Carbon Engineering Co.
Chapin Co., Chas. E., 227 Fulton St., New York, N. Y. ..... C W S L
Columbia Machine Wks. & M. I. Co., 283 Chestnut, Brooklyn, N. Y. ..... H
Cooley Mfg. Co., 98 Park Place, New York .. W
Diamond C. See Chapin Co., Chas. E.
Dixon Crucible Co., Joseph, Jersey City.....
Electra. See Automotive Mfg. Co.
Electric Accessories Co., 310 York Ave., Philadelphia, Pa. ..... H

Die Castings

Aluminum, Tin, Lead and White Brass, Special Machines, Dies, Tools, Jigs and Stampings

Advance Tool & Die Casting Co.

1654-60 Holton St., Milwaukee, Wis.

Edgewood 284

BRUSHES, Commutator—Continued
Electro-Nite Carbon Co., 308 N. Fourth, Philadelphia, Pa. . . . . .
Eureka Copper Products Corp., North East, Pa. . . . . W S H .
Fleck Carbon Co., 508 Broome, New York C . . . . . .
General Electric Co., Schenectady, N. Y.... C . . . H .
Graphalloy. See Graphite Metalizing Corp.
Graphite Metallizing Corp., 1040 Nepperhan Ave., Yonkers, N. Y. . . . . C . . . H . .
Henrite Products Co., 98 Park Place, New York, N. Y. . . . . C . . . . . .
Holland Trolley Supply Co., 1623 E. 43rd, Cleveland, Ohio . . . . . H . .
Jeandron, W. J., 345 Madison Ave., New York, N. Y. (Imported.) . . . . . C . . . . . .
Keystone Carbon Co., 4630 N. 11th, Philadelphia, Pa. . . . . C . . . . . .
Kohlenite Products Co., 417 W. 28th, New York, N. Y. . . . . C . . . . . .
Le Carbone. See Jeandron, W. J.
Le Valley Vitae Carbon Brush Co., 4851 Grand Central Terminal, New York, N. Y. C . . . . . .
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich. . . . . C . . . . . .
Morganite Brush Co., 33-02 48th Ave., Long Island City, N. Y. . . . . C . . . . . .
National Carbon Co., Cleveland, O. . . . . C . . . . . .
New Process Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. . . . . C L
No Spark. See Calebaugh Self-Lubricating.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, Ohio . . . . . C W . . . L
Ohio Elec. Specialty Mfg. Co., Troy, O.... . . W . . . .
Perfection Supply Co., 98 Park Pl., New York, N. Y. . . . . C W S H L
Pittsburgh Carbon Brush Co., 127 Fancourt, Pittsburgh, Pa. . . . . C . . . . . .
Pure Carbon Co., Wellsville, N. Y..... C W S . . L
Pyramid. See National Carbon Co.
Reaction. See Baylis Co.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y. . . . . W . . . L
Salem Electrical Supply Co., Salem, Mass. . . W . . . .
Seabury, Ralph L., Factories Bldg., Toledo, O. C . . . . . .
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. . . . . C . . . . . .
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y. . . . . C L
Speer Carbon Co., St. Mary's, Pa. . . . . C . . . . . .
Stackpole Carbon Co., St. Mary's, Pa.... C . . . . . .
Sterling. See Carbon Laboratories Co.
Superior Carbon Products Co., North Rd., Poughkeepsie, N. Y. . . . . C . . . . . .
U. S. Graphite Co., Saginaw, Mich. . . . . C . . . . . .
Unico. See Universal Carbon Co.
Universal Carbon Co., Dundee, Ill. . . . . C . . . . . .
Universal. See Graphite Metalizing Corp.
Weber Elec. Wks., Brooklyn Sta., Cleveland. C L

BRUSHES, PNEUMATIC SPRAYING. See Spraying Outfits.

BRUSHES FOR VACUUM CLEANERS

Omaha Brush Co., 320 N. 15th, Omaha, Neb. (Brushes rebristled.)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUGGIES, Armature. See Lifts, Armature.

BULBS, Glass

For Incandescent Lamps and Tubes.
Almo Mfg. Co., 38 Crawford, Newark, N. J.
Fayette Glass Bulb Co., 229 21st, Brooklyn, N. Y.
Libby Glass Co., Toledo, O.

BUNCHING MACHINES. See Wire Manufacturing Machines.

BUSHINGS, SHAFT. See Bearings and Bushings.

CABINET GRILL CLOTH. See Cloth, Untreated.

CABINETS, Ice Cream. See Refrigerator Cabinets.

CABINETS, Fibre

Diamond State Fibre Co., Bridgeport, Pa.
Vulcawood. See Diamond State Fibre Co.

CABINETS, Refrigerator. See Refrigerator Cabinets.

CABINETS, Sheet Steel

Stamped and Turned-up Boxes and Cabinets.
Acme Blow Pipe & Sheet Metal Wks., New Orleans, La.
Adam Electric Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Benjamin Elec. Co., 1378 E. 16th, Los Angeles, Cal.
Berks Engineering Co., Reading, Pa.
Berthold Elec. Co., Gus, 555 W. Monroe, Chicago, Ill.
C. & P. Electric Wks., Springfield, Mass.
Cleveland Switchboard Co., 2925 E. 79th, Cleveland, O.
Coast Specialty Co., 72 E. Sixth, Portland, Ore.
Cole Metal Products Co., 33 Crescent, Long Island City.
Columbia Elec. Mfg. Co., 59 Columbus Sq., San Francisco, Cal.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Columbian Steel Tank Co., 1505 W. 12th, Kansas City, Mo
Commercial Mfg. & Supply Co., 1443 Delaware St., Denver.
Diamond Elec'l Mfg. Co., 1330 E. 16th, Los Angeles, Cal.
Dowman-Doxier Mfg. Co., 1314 Murphy Ave., S. W., Atlanta, Ga.
Electric Box & Switchboard Co., 500 S. Thorp, Chicago.
Electric Panelboard Co., 426 Exchange, Rochester, N. Y.
Electric Apparatus Co., 702 N. Halsted, Chicago, Ill.
Federal Steel Products Co., 2 Ave. L, Newark, N. J. (Polarized Boxes.)
Fouch Elec. Mfg. Co., 105 N. Ninth, Portland, Ore.
Greater New York Metal Box Co., Inc., 143 W. 19th, New York.
Green Elec. Co., 31 N. Water, Rochester, N. Y.
Gurney Sheet Metal Wks., 718 E. 4th, Long Beach, Cal.
Hauer, J. B., Driggs Ave. and N. 11th, Brooklyn, N. Y.
Holzer Sheet Metal Wks., Inc., New Orleans, La.
Hough Mfg. Co., 3520 24th, Detroit, Mich.
Isert Co., J. H., 1234 Rowan, Louisville, Ky.
Karp Metal Products Co., 129 30th, Brooklyn, N. Y.
Kirtland Elec. Construction Co., 34 Herkimer, Albany, N. Y.
Large-Dail Mfg. Co., 406 Cherry St., Philadelphia.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lexington Elec. Products Co., 419 E. 24th, New York, N. Y.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Mansfield Elec. Hardware Co., Longview Ave., Mansfield, O.
Metropolitan Elec. Co., 2914 First Ave., S., Seattle, Wash.
Metropolitan Elec. Products Co., Blvd. at 14th, Long Island City, N. Y.
Milwaukee Vault & Cabinet Co., 521 Market, Milwaukee.
Mosher, S. L., 1951 Lawrence, Denver, Colo.
National Metal Box Co., Van Dyke & Ferris Sts., Brooklyn.
Newman Elec. & Mfg. Co., Eau Claire, Wis.
Parr Metal Products Corp., 3519 41st, Long Island City, N. Y.
Penn Electrical Co., 35 Water, Irwin, Pa.
Powerlite Switchboard Co., 4149 E. 79th, Cleveland, O.
Rezioh. See Holzer Sheet Metal Works.
Robbins & Myers, Inc., Springfield, O.
Security. See Aurora Steel Products Co.
Standard Metal Box Corp., 950 Grand St., Brooklyn, N. Y.
Star Metal Box Co., 233 46th, Brooklyn, N. Y.
States Elec. Mfg. Co., 703 Plymouth Ave., N., Minneapolis.
Superior Switchboard & Devices Co., 420 Schroyer Ave., Canton, O.
Tanner & Co., Wm. F., 511 S. Sharp, Baltimore, Md.
United Metal Box Co., 473 President, Brooklyn, N. Y.
United Sheet Metal Wks., 575 Howard, San Francisco.
Universal Metal Box & Products Co., 316 Colt, Irvington,
Wadsworth Elec. Mfg. Co., Covington, Ky.
Wurdack Elec. Mfg. Co., 4444 Clayton Ave., St. Louis, Mo.

CABINETS AND BOXES, Wood

Ampere. See Donehue Lumber Co.
Aston Cabinet Mfrs., 1223 W. Lake, Chicago, Ill.
Boehm Cabinet Co., J., 2216 W. 63rd St., Cleveland, O.
Buckeye Mfg. Co., Springfield, O.
Carolina Wood Products Co., Asheville, N. C.
Carrom Co., Ludington, Mich.
Caswell-Runyon Co., Huntington, Ind.
Cheney Piano Action Co., A. C., Castleton, N. Y.
Clinton Corp., 342 Madison Ave., New York, N. Y.
Corlieth Cabinet Mfg. Co., St. Mary's, Pa.
Cory Cabinet Corp., Springfield, Mo.
Deimer Co., Geo., Henderson, Ky.
Donehue Lumber Co., Smith and State, Perth Amboy, N. J.
Effein & Sons, Frederick, 44 Central Ave., Brooklyn, N. Y.
Empire-United Hat Block Co., 312 E. 22nd, New York.
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Excello Products Corp., 4836 W. 16th, Cicero, Ill.
Grand Rapids Furniture Co., Grand Rapids, Mich.
Harper Mfg. Co., Cassopolis, Mich.
Hickory Box Co., Hickory, N. C.
Hubbell, H. L., 59 Market Ave., N. W., Grand Rapids, Mich.
Interstate Woodworking Co., 46 Wooster, New York, N. Y.
Karpen. See Studner Bros.
King Mfg. Corp., Rano & Crowley, Buffalo, N. Y.
Klumpp Sons, John G., 13 Baxter, New York, N. Y.
National Cabinet Co., New Philadelphia, O.
New England Box Co., Greenfield, Mass.
Ottawa Furniture Co., Holland, Mich.
Pierson Co., 836 Cedar, Rockford, Ill.
Pooley Co., 16th & Indiana Ave., Philadelphia, Pa.
Radio Allied Mfrs. Corp., 1340 S. Michigan Ave., Chicago,
Radio Cabinet & Equipment Co., 1504 Vine, Philadelphia.
Radio Mfg. Co., Div. of Pilliod Lumber Co., Swanton, O.
Radio Master Corp., Bay City, Mich.
Red Lion Cabinet Co., Red Lion, Pa.
R E. Z. Cabinet Co., 54 North, Boston, Mass.
Rockford Sales Corp., 206 Lexington Ave., New York, N. Y.
Schutz Bros., 152 Chambers, New York, N. Y.
Signal Elec. Mfg. Co., 1904 Broadway, Menominee, Mich.
Southern Toy Co., Hickory, N. C.
Specialty Display Case Co., Kendallville, Ind.
Stradivara Co., Coshocton, Ohio.
Straus Cabinet Wks., Eugene, Baxter Ave., Louisville, Ky.
Stretmer Phonograph Corp., 218 E. 75th, New York.
Studner Bros., 67 W. 44th, New York, N. Y.
Superior Cabinet Corp., 206 Broadway, New York, N. Y.
Syracuse Screen & Grille Co., North Manchester, Ind.
Tessier Bros., 355 Bridge, Northampton, Mass. (Radio.)
Trenton Wood Specialty Co., Stokes Ave. and P. R. R., Trenton, N. J.
Udell Wks., 28th and Barnes Ave., Indianapolis, Ind.
West Box Co., 235 Liberty, Springfield, Mass.

CABLE ARMORING MACHINES. See Wire Manufacturing Machines.

CABLE TEST SETS. See Instruments, Portable and Switchboard.

CABLING MACHINES. See Wire Manufacturing Machines.

CANDLES, Fixture

Glass, Fibre Paper.
Brandywine Fibre Products Co., 1402 Walnut, Wilmington,
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Fibro Products Co., New Bedford, Mass.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Seamless. See Fibro Products Co.

CANOPY (Canopies). See Fixture Fittings.
Insulators. See Insulators.
Switches. See Switches, Snap.

CAPACITORS, RADIO. See Radio Circuit Components.

CARBON, Powdered

Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.

CARBONS, Battery. See Carbons.
Arc Light. See Carbons.

CARBONS

Battery Arc Light.
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.
Columbia. See National Carbon Co.
Daylight. See National Carbon Co.
Lessing Battery. See Blanck & Carrier Corp.
Nuernberg Battery. See Blanck & Carrier Corp.
National Carbon Co., Cleveland, Ohio.
Oretip. See National Carbon Co.
Silvertip. See National Carbon Co.
Speer Carbon Co., St. Mary's, Pa.
Stackpole Carbon Co., St. Mary's, Pa.

CARTONS. See Boxes and Wrappers.

CASES, Eliminator. See Cases, Eliminator.
Flashlight. See Cases, Flashlight.

CASES, Eliminator

Luna Tin Mfg. Co., 547 W. 21st, New York, N. Y.

CASES, Flashlight

Bridgeport Brass Co., 744 E. Main, Bridgeport, Conn.
Lincoln Fibre Specialty Co., Newport, Del.
St. Louis Paper Can & Tube Co., St. Louis, Mo.
Underwood Battery Co., 1250 Ontario, Cleveland, O.

CASTINGS, Aluminum. See Castings, Aluminum. Also
Castings, Copper, etc.
Brass. See Castings.
Bronze. See Castings.
Copper. See Castings.
Die. See Castings, Die.
Monel Metal. See Castings.
Steel. See Castings, Steel.
White Metal. See Castings.

CASTINGS, Aluminum

Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Quality Aluminum Casting Co., Waukesha, Wis.

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CASTINGS

Copper, Brass, Bronze, Monel Metal, White Metal.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Bohn Aluminum & Brass Corp., 2512 E. Grand Blvd., Detroit.
Central Pattern & Foundry Co., 3737 S. Sacramento Ave., Chicago, Ill.
Chase Brass & Copper Co., Waterbury, Conn.
Faries Mfg. Co., Decatur, Ill.
McGill Metal Co., Valparaiso, Ind.
Ohio Pattern Wks. & Fdy. Co., 2730 Spring Grove Ave., Cincinnati, O.
Rabun Bronze Foundry, 617 West Belgrave, Huntington Park, Cal.
Sterling Art Metal Wks., 40 Purvis, Long Island City, N. Y.

CASTINGS, Die

Advance Tool & Die Casting Co., 1654 Holton, Milwaukee, Wis.
Alemite Die-Casting & Mfg. Co., 2640 Belmont Ave., Chicago, Ill.
Allied Die-Casting Corp., Long Island City, N. Y.
Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Aluminum Industries, Inc., 2438 Beekman, Cincinnati, O.
American Die Casting Co., 2040 Dominick, Chicago, Ill.
Badger Die Casting Co., 156 East Buffalo, Milwaukee, Wis.
Barnhardt Bros. & Spindler, Monroe & Thropp St., Chicago, Do-Pi. See Doehler Die Casting Co.
Doehler Die Casting Co., 386 Fourth Ave., New York, N. Y.
Franklin Die Casting Corp., Syracuse, N. Y.
Illinois Die Castings Co., 503 S. Jefferson, Chicago, Ill.
Milwaukee Die Casting Co., 289 Fourth, Milwaukee, Wis.
Newton Die Casting Corp., New Haven, Conn.
Perfection Die Casting Corp., 406 Lakeside Ave., N. W., Cleveland, O.
Permite. See Aluminum Industries, Inc.
Stewart Die Casting Co., 4500 Fullerton Ave., Chicago, Ill.
Superior Die Casting Co., 875 E. 70th, Cleveland, Ohio.
Twin City Die Castings Co., Talmadge and 33rd Ave., Minneapolis, Minn. (White Metal).

CASTINGS, Gray Iron

American Engineering Co., Philadelphia, Pa.
Athens Foundry Co., Athens, Pa.
Barlow Foundry Co., 551 N. J. R. R. Ave., Newark, N. J.
Barnett Foundry Co., Newark, N. J.
North Wales Mach. Foundry Co., North Wales, Pa.
Snead & Co., Pine St., Jersey City, N. J.
Sacks Iron Foundry, L., 357 Wilson Ave., Newark, N. J.
St. Louis Malleable Castings Co., 7701 N. Conduit Ave., St. Louis, Mo.

CASTINGS, Steel

Bonney-Floyd Co., Columbus, Ohio.
Eastern Steel Casting Co., Ave. L & Edward St., Newark.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Riverside Steel Casting Co., Jacobus Ave., Kearney, N. J.

CEMENT, Commutator

Armstrong. See Electric Power Maintenance Co.
Conductalute. See Technical Products Co.
Early, Edward E., 1129 W. Fifth, N. W., Canton, O.
Electric Power Maintenance Co., 21 N. Third, Minneapolis.
Imperial. See Martindale Electric Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, O.
Mitchell Rand Mfg. Co., 19 Vesey, New York, N. Y.
Perce-Lute. See Perfection Supply Co.
Perfection Supply Co., 98 Park Pl., New York, N. Y.
Plas Mica Co., 26 St. Andrews Place, Yonkers, N. Y.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CEMENT, Liquid Porcelain

Anchorlute. See Technical Products Co.
Fire Lute. See Technical Products Co.
Insa-Lute. See Technical Products Co.
Okonite Co., Passaic, N. J.
Repairet Mfg. Co., Milwaukee, Wis.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Thermold. See Technical Products Co.

CHAIN, Chandelier (Fancy). See Crystals, Chandelier.

CHAIN DRIVES. See Chain, Power Transmission.

CHAIN, Fixture

Acco. See American Chain Co.
American Chain Co., Bridgeport, Conn.
Chase Brass & Copper Co.
Eastern Chain Works, 309 E. 22nd St., New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Globe Metal Mfg. Co., 2122 E. Hazard, Philadelphia, Pa.
H. & O. Chain Co., So. Norwalk, Conn.
Newark Metal Mfg. Co., 22 S. 6th, Newark, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Universal Metal Chain Co., 75 Clymer, Brooklyn, N. Y.

CHAIN, Power Transmission

American High Speed Chain Co., 221 E. South, Indianapolis
Baldwin Chain & Mfg. Co., Worcester, Mass.
Boston Gear Wks. Sales Co., Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Company, Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Reeves Pulley Co., Columbus, Ind.
Renold Boston. See Boston Gear Wks.
Whitney Mfg. Co., Hartford, Conn.

CHAIN, Socket

American Ball Chain Works, 13 Wooster St., New York.
Read Chain Mfg. Co., Bridgeport, Conn.
H. & O. Chain Co., South Norwalk, Conn.

CHANDELIER BEADS. See Crystals, Chandelier.

CHANDELIER CRYSTALS. See Crystals, Chandelier.

CHANDELIER FRINGE. See Crystals, Chandelier.

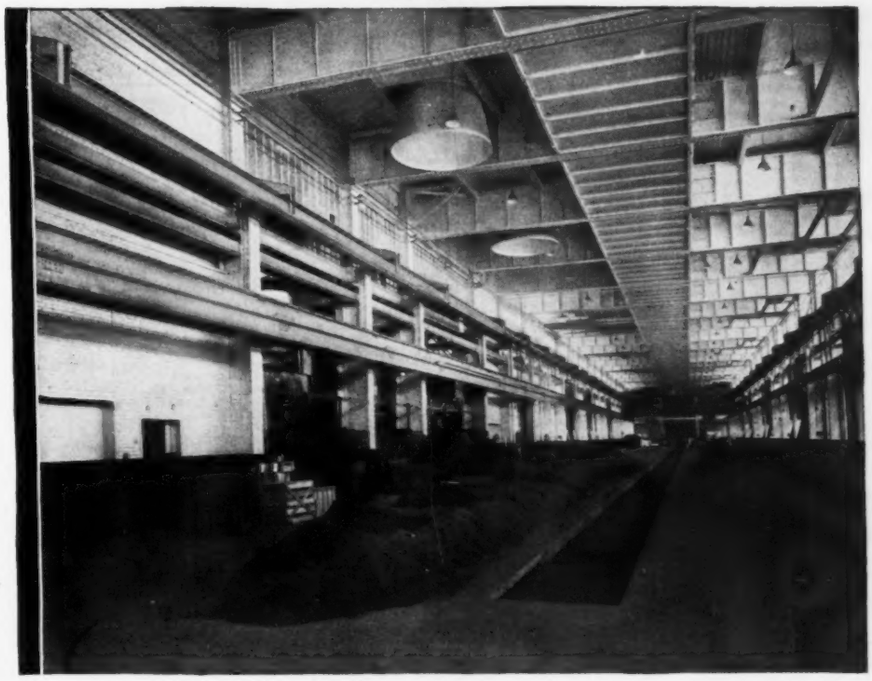
CHARGERS, Magnet

Charging, Remagnetizing.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Cowie Elec. Co., E. S., 1823 Wyandotte, Kansas City, Mo.
Fore Elec. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.

For Foundries, Too—

ALUMINUM PAINT

The Aluminum Painted Foundry interior of the Westinghouse Air Brake Company, Pittsburgh, Pa.



Trade Mark

The pigment base for the better grades of Aluminum Paint is ALBRON made of pure ALCOA Aluminum.

In buying Aluminum Paint, tell your dealer how you propose to use it—and whether indoors or out. Most good paint dealers are prepared to furnish the kinds best suited to your needs. If yours is not, write us, giving his name and address, and we will see that he is supplied.

FOUNDRY conditions are probably more exacting than those in almost any other service to which paint is subjected. Nevertheless, old-fashioned, dark, dingy, unkempt-looking foundries are rapidly dropping from sight. For industry has found a paint, the brightness of which, not even foundry fumes and dirt can dim—Aluminum Paint.

The silvery gray color of Aluminum Paint diffuses an abundance of light that banishes dinginess and brightens dark corners. It presents a surface that does not discolor easily and is readily washed down without injury to itself. When scraped or abraded it can be spot painted without showing unsightly splotches where new paint covers old.

And Aluminum Paint is durable, too. Its tough film of pure metallic Aluminum is impervious to smoke fumes, acid fumes and gases. It is non-rusting, waterproof—hence, it gives excellent protection to exposed surfaces of every character, iron, steel, wood, brick or concrete.

It spreads farther, covers better and lasts longer than ordinary paint and, usually, fewer coats are required. Yet it costs no more than paints which do not possess its exclusive advantages. It is decidedly economical.

Every manufacturer will find the booklet, "Aluminum Paint, the Coat-of-Metal Protection," both interesting and profitable to read. We will be glad to send you a copy on request.

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Serrwell Sales Corp., 1749 N. Winchester Ave., Chicago.
Valley Electric Co., 4221 Forest Park Blvd., St. Louis, Mo.

CHEMICALS, Battery
Electrolyte, Battery Salts, Battery Oxides, Sal Ammoniac, Bluestone, Manganese.
Cooper & Co., Charles, 194 Worth, New York, N. Y.
Eagle-Picher Lead Co., 134 N. LaSalle, Chicago. (Oxide.)
Eimer & Amend, 205 3rd Ave., New York, N. Y.
Electro Chemical Co., 113 W. Court St., Dayton, O.
General Metallic Oxides Co., Jersey City, N. J.
Globe Chemical Co., Murray Rd. and Big Four R. R., Cincinnati, O.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Kalbfleisch Corp., 200 5th Ave., New York, N. Y.
Klipstein Co., 644 Greenwich, New York, N. Y.
Merrimac Chemical Co., 148 State, Boston, Mass.
Powers-Weightman-Rosengarten Co., Philadelphia, Pa.
Voltah. See Powers-Weightman-Rosengarten Co.
Wah Chang Trading Corp., 233 Broadway, New York, N. Y.

CHEMICALS, Refrigeration
Ansul Chemical Co., Marinette, Wis.
Arctic. See Roessler & Hasslacher Chemical Co.
Carbide & Carbon Chemicals Corp., 30 E. 42nd, New York, N. Y. (Butane & Isobutane.)
Dry Ice Corp. of America, 50 E. 42nd, New York, N. Y.
Roessler & Hasslacher Chemical Co., 709 Sixth Ave., New York, N. Y. (Methyl Chloride, Ethyl Chloride.)
Virginia Smelting Co., West Norfolk, Va. (Sulphur Dioxide.)
Chromium Plating. See Plating & Finishing.

CHUCKS, Magnetic
Simmons. See Taft-Pierce Mfg. Co.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S. (Rockdale), Worcester, Mass.

CIRCUIT BREAKERS
Air and Oil Circuit Breakers and Oil Break Switches.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Anderson Mfg Co., Albert & J. M., 289 A, Boston, Mass.
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Automatic Switch Co., 617 E. Larned, Detroit, Mich.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cramblet Engineering Corp., 286 Milwaukee, Milwaukee.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
General Electric Co., E. M. 12, Merchandise Dept., Bridgeport, Conn.
Inducto-therm. See Allen-Bradley Co.
I. T. E. Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia, Pa.
Line Material Co., South Milwaukee, Wis. (Oil Switches.)
Maple Co., R. H., Indianapolis, Ind.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Minibraker. See Burke Controller Co.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sentinel. See Westinghouse Elec. & Mfg. Co.
Takamine Corp., 208 Rawson, Long Island City, N. Y.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
U-Re-Lite. See I. T. E. Circuit Breaker Co.
Ward Leonard Elec. Co., Mount-Vernon, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
CIRCUIT TESTERS. See Testers, Fuse and Circuit.
CLEANER BAGS, Vacuum. See Bags, Vacuum Cleaner.
CLEANER BRUSHES, Vacuum. See Brushes for Vacuum Cleaners.

CLEANERS, Metal
Oakite Products, Inc., 26 Thames, New York, N. Y.
CLIPS, Fuse. See Fuse Clips.

CLIPS, Heater Plug
Gray Bros. Co., Piano, Ill.
CLOCK SWITCHES. See Switches, Time.
CLOTH GEARS. See Gears and Pinions, Composition.
CLOTH LOUD SPEAKER DIAPHRAGM. See Cloth, Untreated.
CLOTH RADIO GRILL. See Cloth, Untreated.

CLOTH UNTREATED
Boyle & Co., John, 112 Duane, New York, N. Y.
Canvas, "Aeroplane Cloth," Cotton Duck, Drill, Diaphragm Cloth, Grill Fabrics, etc
Tindall Fabrics Corp., 200 Madison Ave., New York, N. Y. (Grill Cloth).

CLOTH AND PAPER, Insulating

Cloth, Insulated	See C					
Paper, Insulated	See P					
Fibre Paper (Fish Paper)	See F					
Press Board (Fuller Board)	See B					
Silk	See S					
Acme Wire Co., New Haven, Conn.		C	S	P		
Armco. See Rogers Paper Mfg. Co.						
Armatite. See Mica Insulator Co.						
Brand & Co., Wm., 268 Fourth Ave., New York				P		
Campbellite. See Campbell Fibre Co.						
Campbell Fibre Co., Stanton, Delaware						B
Carboloid Products Corp., 15 Park Row, New York, N. Y.				C		P
Case Brothers, Inc., Highland, Park, Conn.						P B
Case Mfg. Co., Unionville, Conn.						P
Case & Risley Press Paper Co., Oneco, Conn.						
C-F. See Campbell Fibre Co.						
Celoron Co., Bridgeport, Pa.					F	F B
Chicago Mica Co., Valparaiso, Ind.				C		
Dexstar. See Dexter & Sons.						
Dexter & Sons, C. H., Windsor Locks, Conn. (Condenser Tissue.)						
Diamond State Fibre Co., Bridgeport, Pa.					P	
Dielectric Mfg. Co., St. Louis, Mo.			C	S	P	B
Federal Insulating Corp., Yonkers, N. Y.			C		P	F
Fyberoid. See Wilmington Fibre Specialty Co.						
General Electric Co., E. M. 12, Merchandise Dept., Bridgeport, Conn.			C		P	
Hartford City Paper Co., Hartford City, Ind. (Glassine Condenser Tissue).						
Hewitt & Bros., C. B., 16 Ferry, New York		C		P		
Hi-Tex. See Stevens Paper Mills.						
Incella. See Tarentum Paper Mills Co.						
Irvington Varnish & Insulator Co., Irvington, N. J.			C	S	P	
Manning Paper Co., J. A., Troy, N. Y.						B
Mica Insulating Co., 200 Varick, New York		C	S	P		B
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.					P	
National Vulcanized Fibre Co., Wilmington, Del.						F
New Jersey Wood Finishing Co., Woodbridge, N. J.			C			
Ohmoid. See Wilmington Fibre Specialty Co.						
Old Hick. See Hewitt & Bros., C. B.						
Peerless. See National Vulcanized Fibre Co.						
Rogers Fibre Co., 210 Lincoln, Boston, Mass.						F
Rogers Paper Mfg. Co., South Manchester, Conn.						B
Schweitzer, Inc., Peter J., 200 Fifth Ave., New York, N. Y. (Condenser Tissue.)						
Seutan Co., 342 Madison Ave., New York					P	
Sico. See Standard Insulation Co.						
Standard Insulation Co., Rutherford, N. J.		C	S	P		
Sterling Fireboard Co., 501 Fifth Ave., New York. (Varnished Hard Fibreboard)						B

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Sterlite. See Sterling Firebrand Co.
Stevens Paper Mills, Windsor, Conn. B
Tarentum Paper Mills Co., Tarentum, Pa. P
Turbonite. See Brand & Co., Wm.
Union Mills Paper Mfg. Co., New Hope, Pa. P
Warren Mfg. Co., 342 Madison Ave., New York, N. Y. P
West Virginia Pulp & Paper Co., 200 5th Ave., New York B
Wilmington Fibre Specialty Co., Wilmington, Del. P

CLUTCHES, Magnetic
Cutler-Hammer Mfg. Co., Milwaukee, Wis.

COIL (Coils).
Armature and Field. See Coils, Finished.
Choke (Power). See Fittings, High Tension.
Choke (Radio). See Radio Circuit Components.
Driers & Impregnators. See Ovens.
Electromagnet. See Coils, Finished.
Flatteners. See Rolls, Coil Flattening.
High Frequency. See Electro-Therapeutic; also Radio Circuit Components; also Ignition Outfits.
Impregnators, Vacuum. See Ovens, Industrial.
Induction. See Coils, Finished; also Electro-Therapeutic.
Loop Benders. See Benders, Coil Loop.
Medical. See Electro-Therapeutic.
Presses. See Presses, Armature Coil.
Radio. See Radio Circuit Components.
Removers. See Removers, Coil.
Resistance. See Units, Rods & Grids; also Radio Circuit Components.
Shaping Machines. See Shaping Machines, Coil.
Spark. See Ignition Outfits.
Spreaders. See Winding Machines, Armature & Field Coil.
Taping Machines. See Taping Machines, Coil.
Tesla. See Ignition Outfits.
Testers. See Testers, Coil; also Test Benches, Armature.
Winders, Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Winders, Induction Coil. See Winding Machines, Industrial Coil.
Winding Forms. See Forms, Coil Winding.
Windings (Magneto). See Coils, Finished.
Wire Tension Devices. See Tension Devices, Coil Wire.

COILS, Finished
Armature, Field, Electromagnet and Induction Coils.
Acme Products Co., 22 Elkins (South Boston), Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Auth Electrical Specialty Co., 422 E. 53rd St., New York, N. Y.
A. & A. See Electrical Coil Winding Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bunnell & Co., J. H., 32 Park Place, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cameron Elec. Mfg. Co., Ansonia, Conn.
Colilon Elec. Mfg. Co., Easton, Pa.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Indiana.
Easton Coil Co., Easton, Pa.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electrical Coil Winding Co., 27th & Sanderson Sts., Camden, N. J.
Electrical Products Mfg. Co., Providence, R. I.
Irvington Varnish & Insulator Co., Irvington, N. J.
Marion Elec. Mfg. Co., 24 Cliff, Jersey City, N. J.
Modern Elec Mfg. Co., 312 Mulberry, Toledo, Ohio.
National Elec. Corp., 226 High, Newark, N. J.
Pfer Elec. Repair & Mfg. Co., 3610 Superior Ave., Cleveland, O.
Robertson-Davis Co., 361 W. Superior, Chicago, Ill.
Robertson, Leo F., 536 West 22nd St., New York, N. Y.
Sevison Magneto Engrg. Co., 397 Phillips, Toledo, O.
Stunz & Barron, 210 E. Pratt, Baltimore, Md.
Toledo Standard Commutator Co., 2242 Smead Ave., Toledo, O.
Universal Winding Co., Boston, Mass.
U. S. Armature Service Co., 1617 S. Michigan Ave., Chicago, Ill.
Varley Duplex Magnet Co., 15 Exchange Place, Jersey City, N. J. (Electromagnetic only).
Whittier & Ditmar, Inc., 1611 Beacon, Brookline, Mass.

COMMUTATOR
Bars. See Bars, Commutator.
Cement. See Cement, Commutator.
Dressers. See Stones, Commutator.
Lubricants. See Compounds, Commutator.
New. See Commutators.
Refilled. See Repairing and Second Hand.
Slotters. See Slotting Machines & Tools, Commutator.
Slotting Files. See Files, Commutator Slotting.
Soldering Machines. See Soldering Machines, Commutator.
Stones. See Stones, Commutator.
Tighteners. See Tighteners, Commutator.
Truing Devices. See Tools, Commutator Truing.

COMMUTATORS
Derby Commutator Co., Derby, Conn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., Cleveland, Ohio.
COMMUTATOR BRUSHES. See Brushes, Commutator.
COMPOSITION PULLEYS. See Pulleys, Composition.
COMPOUNDS, Sealing. See Wax and Compounds.

CONDENSER UNITS, Refrigerator
Bush Mfg. Co., Hartford, Conn.
McCord Radiator & Mfg. Co., Riopelle & E. Grand Ave., Detroit, Mich.
Rome-Turney Radiator Co., Rome, N. Y.

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CONDENSERS, Radio. See Radio Circuit Components.
CONDENSER TUBING. See Tubing, Brass and Copper.
CONTACT POINTS. See Points, Contact.
CONTAINERS, Shipping. See Fibre Board Products.

CONTROLLERS, Motor
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Anderson & Co., C. J., 212 W. Austin, Chicago, Ill.
Automatic Switch Co., 154 Grand, New York, N. Y.
Betts, Inc., James H., 1393 Sedgwick Ave., New York, N. Y. (Traffic.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
B-Q Oil Burner Co., Stockton, Cal.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee
Dinkey. See Elec. Controller & Mfg. Co.
E. C & M Youngstown. See Electric Controller & Mfg. Co.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O
Electrite. See Sundh Elec. Co.
Diamond Elec. Mfg. Co., 1330 N. 16th, Los Angeles, Cal.
General Electric Co., Schenectady, N. Y.
Horni Signal Mfg. Corp., 292 Hudson, New York, N. Y.
Industrial Controller Co., S. Pierce & Hanover, Milwaukee, Wis.
Maimin Co., H., 251 W. 19th, New York. (Sewing Machines.)
Monitor Controller Co., 51 Gay, Baltimore, Md.
National Electric Controller Co., 5315 Ravenswood Ave., Chicago, Ill.
Refrigerating Specialties Co., 728 S. Sacramento Blvd., Chicago, Ill.
Rowan Controller Co., 306 N. Holliday, Baltimore, Md.
Square D Co., 6060 Rivard, Detroit, Mich.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Switcholone. See Condit Elec. Mfg. Co.
Thermaload. See Monitor Controller Co.
Trumbull Electric Mfg. Co., Plainville, Conn.
Uemco. See Union Elec. Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
W. K. See Westinghouse Elec. & Mfg. Co.
COPPER. See Brass, Bronze and Copper; also Castings
COPPER TUBING. See Tubing, Brass and Copper.
CORD TIPS. See Tips, Cord.

CORES, RESISTANCE COIL (Lava)
American Lava Corp., 1425 William, Chattanooga, Tenn
Crescent. See M. Kirchberger & Co.
Es-El-Co. See Southern Lava Co.
Kirchberger & Co., M., 1425 37th, Brooklyn, N. Y.
Lavite. See Steward Mfg. Co.
Lavarock. See M. Kirchberger & Co.
Southern Lava Co., Rossville, Ga.
Steward Mfg. Co., D. M., Chattanooga, Tenn.
Tennessee Burner Mfg. Co., Chattanooga, Tenn.
XL. See Tennessee Burner Mfg. Co.

CORES, RESISTANCE COIL (Refractory Porcelain)
American Lava Corp., 1425 William, Chattanooga, Tenn.
Colonial Insulator Co., Akron, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Elemite. See Louthan Mfg. Co.
Fireite. See Hartford Faience Co.
Hartford Faience Co., Hartford, Conn.
Louthan Mfg. Co., E. Liverpool, O.
Thermal Syndicate, 58 Schenectady Ave., Brooklyn, N. Y.
Vitrecoil. See Thermal Syndicate.
COTTON DUCK. See Cloth, Untreated.
COTTON SLEEVING. See Tape, Cotton.
COUNTERS, Revolution. See Tachometers.

COUPLINGS, Shaft (Flexible-Insulated)
Bartlett Hayward Co., Baltimore, Md.
Delbee Rubber Co., Syracuse, N. Y.
Falk Corp., Milwaukee, Wis.
Franke. See Smith & Serrell.
General Electric Co., Schenectady, N. Y.
Lipe, W. C., Syracuse, N. Y.
Lovejoy Tool Wks., 319 W. Ohio, Chicago, Ill.
Oneida. See Delbee Rubber Co.
Smith & Serrell, 24 Washington Pl., Newark, N. J.
Wood's Sons Co., T. B., Chambersburg, Pa.
COVERING MACHINES, WIRE. See Wire Manufacturing Machines.

CUPS, Grease
Bowen Products Corp., Auburn, New York.
Lunkenheimer Co., Cincinnati, Ohio.
CUT OUTS, Battery. See Switches, Battery.
CUTTING OUTFITS, Metal. See Welding and Cutting Outfits.
CRANES, Floor. See Lifts, Armature.

CRYSTALS, Chandelier
Crystals, Prisms, Beads, Chains, Fringes.
Crystal Venezia. See Harrison & Co., Arthur.
Friedlaender Co., 49 W. 23rd, New York, N. Y.
Harrison & Co., Arthur, 561 W. Washington Blvd., Chicago.
Hirschberg, Shutz & Co., 268 4th Ave., New York, N. Y. (Fringes.)
Nelson Bead Co., 15 W. 37th, New York, N. Y. (Importer)
Rialto Import Co., 112 W. 4th, New York, N. Y.
Schwartz Lighting Fixture Wks., 1341 Noble, Philadelphia
Wyle & Bros., J. J., 20 E. 27th, New York, N. Y.
CURRENT INDICATORS. See Instruments, Pocket.
DASHBOARD METERS. See Instruments, Portable and Switchboard.

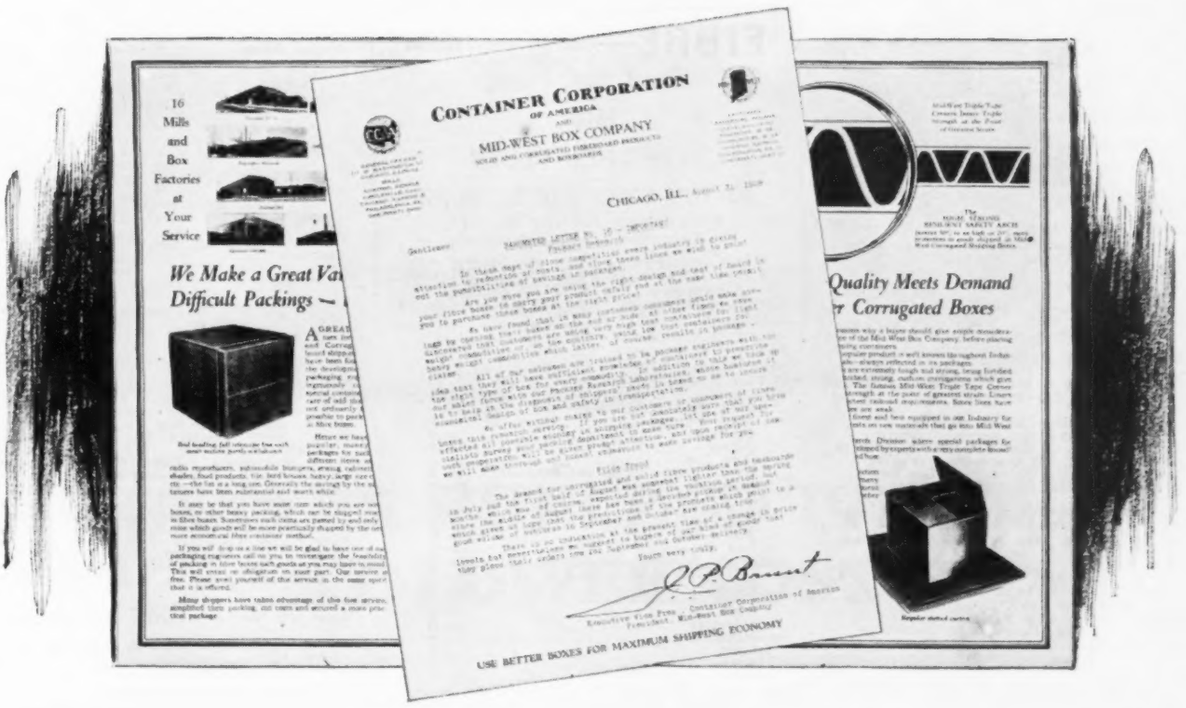
DECALCOMANIA
Meyercord Co., 133 W. Washington, Chicago, Ill.
Novar. See Palm Fechteler & Co.
Palm Fechteler & Co., 67 5th Ave., New York, N. Y.

DIALS
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Enameled. See Dials, Enameled.

DIALS, Enameled
Whittier Co., Horace R., Pequabuck, Conn.
DIAPHRAGM, Cloth. See Cloth, Untreated.
DIE CASTINGS. See Castings, Die.
DIE MAKERS. See Dies, Die Makers.
DIES, Pipe. See Stocks, Dies and Reamers.

DIES, DIE MAKERS
Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill.
Beaver Mfg. Co., 635 N. Third, Newark, N. J.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Mareck & Nebel, 255 Greenwich, New York, N. Y.

DISCS, Armature
Steel Discs, Laminations, and Segments for Motors and Transformers.
American Stamping Co., 978 E. 64th, Cleveland, O.
Cleveland Armature Works, 4732 St. Clair Ave., Cleveland
Hercules Elec. Steel Corp., 145 Lafayette, New York, N. Y.
Lamination Stamping Co., 764 Windsor, Hartford, Conn.
DRAWING MACHINES, WIRE. See Wire Drawing Machines.
DRIVE SCREWS. See Screws, Drive.
DRIVES, CHAIN. See Chain, Power Transmission.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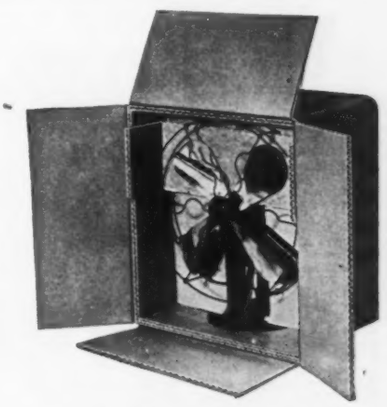

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Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co. Schenectady,
EBONITE. See Rubber, Hard.
ELECTROLYTE. See Chemicals, Battery.
ELECTROMAGNETS. See Coils, Finished.
ELECTRODYNAMOMETERS. See Instruments, Laboratory Standard.
ELEMENTS, Heating. See Units, Rods and Grids.

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Brewster Co., Wm., 30 Church, New York, N. Y.
Deckel. See Preis & Co., Inc., H. P.
Engravograph Corp., 12 Vestry, New York, N. Y.
Etchograph. See Brewster Co., Wm.
Gilbert Supply Co., Independence, Iowa.
Gorton Machine Co., Geo., Racine, Wis.
Preis & Co., Inc., H. P. Newark, N. J.

ENGRAVING, Radio Panel
Engraving to Order.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Elsler Engineering Co., 756 S. 13th, Newark, N. J. (Tube Base Brandes).
Etch-O-Gravure. See Insuline Corp. of America.
Globe Mfg. Co., 101 Spokane St., Seattle, Wash.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
New England Products Co., 232 Greenwich, New York.
Preis & Co., Inc., H. P., 227 Fulton, New York, N. Y.
Schwenke Machine Engraving Co., 2036 Woodward Ave., Detroit, Mich.
Verichrome Laboratories, 4614 Spring Grove Ave., Cincinnati,
Wright Radio Co., 114 Exchange, Rockland, Mass.
ENGRAVING TO ORDER. See Engraving, Radio Panel.

EYELETS
Platt Bros. & Co., Waterbury, Conn.
Waterbury Button Co., 835 S. Main, Waterbury, Conn.
FABRIC, Radio Grill. See Cloth, Untreated.
FABRIC SHADES. See Shades, Fabric.
FAN BLADES. See Blades, Fan.
FEET, FELT. See Felt.

FELT
Advance Felt & Cutting Co., 317½ S. Jefferson, Chicago.
American Felt Co., 211 Congress, Boston, Mass.
Booth Felt Co., 460 18th, Brooklyn, N. Y.
Brawley, T. E., 279 20th, Brooklyn, N. Y.
Western Felt Wks., 4031 Ogden Ave., Chicago, Ill.

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Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, 490 Hancock Ave., Bridgeport, Conn.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Massachusetts Machine Shop, Inc., Boston, Mass.
Patton-MacGuyer Co., Providence, R. I.
Platt Bros. & Co., Waterbury, Conn.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., 99 Mill, Waterbury, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.

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Mid-West Box Co., Dept. 6, 111 W. Washington, Chicago.
Sefton Mfg. Corp., 59 E. Madison, Chicago, Ill.
FIBER CANDLES. See Candles, Fixture.
FIBRE GEARS. See Gears and Pinions, Composition.
Paper. See Cloth and Paper.
Radio Panels. See Radio Molded Parts.
Shipping Containers. See Fibre Board Products.
Vulcanized. See Fibre, Vulcanized.

FIBRE, Phenol
Moisture Proof; Sheet, Rod, Tubes.
Bakelite-Dilecto. See Continental Fibre Co.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Campbellite. See Campbell Fibre Co.
Celoron Co., Bridgeport, Pa.
Continental Fibre Co., Newark, Del.
Fibroc Insulation Co. 245 Lincoln Ave., Valparaiso, Ind.
Formica Insulation Co., 4638 Spring Grove Ave., Cincinnati, O.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Phenolite. See National Vulcanized Fibre Co.
Spaulding Fibre Co., Inc., Tonawanda, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

FIBRE, Vulcanized
Sheet, Rod, Tube, Horn, Fibre, Bushings, Washers, Cleats, Screw Machine Products.
Brandywine Fibre Products Co., 1402 Walnut St., Wilmington, Del.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Conite. See Continental Fibre Co.
Continental Fibre Co., Newark, Del.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond F. See Diamond State Fibre Co.
Diamond State Fibre Co., Bridgeport, Pa.
Egyptian. See Delaware Hard Fibre Co.
Electrosote. See Agnote Millboard Co.
Fibre Products Co., New Bedford, Mass.
Fyberoid. See Wilmington Fibre Specialty Co.
Independent Laboratories, 50 E. 42nd, New York, N. Y.
Iten Fibre Co., 5403 Bower Ave., Cleveland, O.
Leatheroid. See Rogers Fibre Co.
Lincoln Fibre & Specialty Co., Newport, Del.
National Vulcanized Fibre Co., Wilmington, Del.
Ohmoid. See Wilmington Fibre Specialty Co.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass.
Spaulding Fibre Co., Tonawanda, N. Y.
Standard Fibre Products Co., 36 Pleasant, Watertown, Mass.
Vul-Cot. See National Vulcanized Fibre Co.
Vulcawood. See Diamond State Fibre Co.
Wilmington Fibre Specialty Co., Wilmington, Del.
FIBRE WASHERS. See Fibre.
FIELD COILS. See Coils, Finished.

FILAMENTS, Incandescent Lamp
Conneway Elec. Laboratories, 406 Jefferson St., Hoboken.
Filament Supply Co., 1317 Willow Ave., Hoboken, N. J.
Sirian Wire & Contact Co., 255 Sherman Ave., Newark.
Suter & Nustal, 3709½ Lisbon Ave., Milwaukee, Wis.
Volkmar & Sons, 187 Sylvan Ave., Newark, N. J. (Lead-in-Welds.)

FILES, Commutator Slotting
Ideal Commutator Dresser Co., 1008 Park, Sycamore, Ill.
Martindale Electric Co., 1264 W. Fourth, Cleveland, O.
FISH PAPER. See Cloth and Paper.
FITTINGS, Fixture. See Fixture Fittings.

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FIXTURE CANDLES. See Candles, Fixture.
FIXTURE CHAIN. See Chain, Fixture.
FIXTURE, Collars. See Fixture Fittings.

FIXTURE FITTINGS

	KEY
Bowl Holders	See B
Brass Fittings	See B
Canopies	See B
Collars	See B
Crow Feet	See I
Finials (Brass, Glass and Porcelain)	See B
Hangers	See H
Hickies, Brass	See B
Hickies, Iron	See I
Hooks, Brass	See B
Hooks, Iron	See I
Iron Fittings	See I
Loops, Brass	See B
Loops, Iron	See I
Rings	See B
Shade Holders	See S
Shells	See B
Spinnings	See B
Stampings	See B
Stems	See B
Straps	See H
Studs	See I

Acme Lighting Products, Inc., 2114 Woodland Ave., Cleveland, O. Straps. . . . . H
American Chain Co., Bridgeport, Conn. (Loops and Rings.) B . . . . .
American Pin Co., Waterbury, Conn. . . I . . .
American Ring Co., Waterbury, Conn. (Candle.) . . . S . .
Ampinco. See American Pin Co.
Appleton Electric Co., 1703 Wellington Ave., Chicago, Ill. B I . . .
Arco. See American Ring Co.
Arrow Electric Co., Hartford, Conn. . . . S . .
Banlite. See East Side Metal Spinning Co.
Banner. See Plume & Atwood Mfg. Co.
Barton Brass Wks., 3627 Superior, Detroit. . B . . . .
Belmet. See B. & L. Metal Stamping Co.
Bloch Bros., 88 Walker, New York. . . . . B . . . .
Brandt Mfg. Co., 3727 Gratiot Ave., Detroit. B . . . .
Braun, J. G., 609 S. Pauline, Chicago, Ill. (Pressed Ornaments.) B I . . .
B. & L. Metal Stamping Co., 250 Moore, Brooklyn, N. Y. (Also Combination Wall Bracket Hanger.) B I . . H
Cambridge Brass Co., Cambridge, Mass. . . . B . . . .
Chase Brass & Copper Co., Waterbury, Conn. B . . S . .
Cleanetz. See Dunlap Co.
Colonial Stamping Co., Brill St. & Passaic Ave., Newark, N. J. B . . S . .
Crescent Brass Mfg. Co., Reading, Pa. . . . . B . . . .
Crouse-Hinds, Solvay Sta., Syracuse, N. Y. . . . S H
Diamond Needle & Mfg. Co., Torrington, Conn. (Hickies.) . . I . . .
Dunlap Co., John, Carnegie, Pa. . . . . S . .
East Side Metal Spinning Co., 451 Greenwich, New York, N. Y. B . . . . .
Eureka Tin Ware Mfg. Co., 135 W. 20th, New York, N. Y. . . . . S . .
E-Z Up. See Plume & Atwood Mfg. Co.
Faries Mfg. Co., Decatur, Ill. . . . . B I S H
Flaherty Co., M. E., 28 S. Clinton, Chicago. . . I . . .
Fralick Co., S. R., 15 S. Clinton, Chicago. . . I . . .
Franklin Brass Foundry Co., Reading, Pa. . . . B . . . .
Friedley-Voshardt Co., Chicago. . . . . B . . . .
Grabler Mfg. Co., 6565 Broadway, S. E., Cleveland, O. . . I . . .
Hart & Hegeman Mfg. Co., Hartford, Conn. . . . S . .
Incandescent Supply Co., 468 West Broadway, New York, N. Y. B . . . H
Isco. See Incandescent Supply Co.
Jiffy. See White Mfg. Co., J. H.
Kwikon. See Fralick Co., S. R.
Lakin. See Thomas & Betts Co.
Lanco Mfg. Co., 223 Jelliff Ave., Newark, N. J. (Cross Bar.) . . I . . .
Liberty Brass Turning Co., 88 Walker, New York, N. Y. . . I . . .
Liberty Iron Pipe & Nipple Works, 62 Greene, New York, N. Y. B I . . .
Liberty Machine Co., Wauwatosa, Wis. . . . B I . . .
L & K Mfg. Co., 440 Adelphi, Brooklyn, N. Y. . . . . H
L. & W. Brass Wks., 820 Orleans, Chicago, Ill. B . . . . .
Madelite. See Belson Mfg. Co.
M. S. W. Mfg. Co., 1527 Niagara Ave., Buffalo, N. Y. . . I . . .
Metal Products Co., 210 Canal, New York. . . . B . . . .
Metro Iron Ornament Co., 191 Christie, New York, N. Y. . . I . . .
Metropolitan-Columbia Mfg. Co., 714 Metropolitan Ave., Brooklyn, N. Y. B . . . .
Midwest Elec. Co., 1639 Walnut, Chicago, Ill. . . . I . . .
Mid-West Chandelier Co., 14th & Chestnut Sts., Kansas City, Mo. B . . . . .
Michell-Vance Co., 70 Washington, Brooklyn, N. Y. . . . . S . .
Monarch. See Perfeclite Co.
Murlin Mfg. Co., Philadelphia, Pa. . . . . B I . . .
National Electric Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa. (Studs.) . . I . . .
New Era Elec. Mfg. Co., 6725 Machinery Ave., N. E., Cleveland, O. . . . . H
New Wrinkle. See Bryant Elec. Co.
New York Brass Turning Co., 568 Broadway, New York, N. Y. B . . . .
Nobolt. See Fralick & Co., S. R.
N. W. Cleat Receptacle Bracket, 2437 N. 29th, Philadelphia, Pa. . . I . . .
Onli. See Perfeclite Co.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. B . . S . .
Perfeclite Co., 1457 E. 40th, Cleveland. . . . . S . .
Pittsburgh Valve & Fittings Co., Barberton, O. . . I . . .

Plume & Atwood Mfg. Co., Waterbury, Conn. B . . S H
Plumwood. See Plume & Atwood Mfg. Co.
Plymouth. See Vester Sons, Alfred.
Reading Brass Co., 141 Schiller, Reading, Pa. B I . . .
Ribaysen Mfg. Co., J., 952 W. Lake, Chicago, Ill. B . . . . .
Rodale Mfg. Co., 200 Hudson, New York. . . . B . . . H
Sandow Tool Co., 1440 Bway, New York, N. Y. . . . S . .
Scovill Mfg. Co., Waterbury, Conn. . . . . B I . . .
Simpalite. See Sprecher Mfg. Co., P. W.
Simplex. See Plume & Atwood Mfg. Co.
Springfast. See Plume & Atwood Mfg. Co.
Square-G. See Grabler Mfg. Co.
Standard Elec. & Mfg. Co., Cedar Rapids, Ia. B . . . . .
Standard Snap-Lite Corp., 504 Jackson Ave., Long Island City, N. Y. . . . . S . .
Standard Metal Spinning Co., 128 Mott, New York, N. Y. B . . . . .
Star. See Perfeclite Co.
Star. See Steel City Elec. Co.
Steel City Elec. Co., Pittsburgh, Pa. . . . . I . . .
Steele & Johnson Mfg. Co., Waterbury, Conn. B . . S . .
Stembridge, Tenny & Brandt, 29 S. Clinton, Chicago, Ill. (White Metal.) . . . . . B . . . .
Sterling Spinning & Stamping Wks., 476 Broome, New York, N. Y.
T. & B. See Thomas & Betts Co.
Thomas & Betts Co., 63 Vesey, New York. . . . . I . . .
Triumph Mfg. Co., 310-13, West New York, N. J. . . . . S . .
Uno. See Bryant Elec. Co., also Crouse-Hinds, also General Elec. Co., also Hart & Hegeman Mfg. Co., also Pass & Seymour.
United. See L & K Mfg. Co.
United Metal Spinning Co., 440 Adelphi, Brooklyn, N. Y. B . . . . .
Vester, Sons, Alfred, 5 Mason, Providence, R. I. B . . . . .
Victor. See Plume & Atwood Mfg. Co.
Virden, Div. of Gill-Virden Co., 6108 Longfellow Ave., Cleveland, O. B . . . . .
Walden Tool & Metal Mfg. Co., New Haven Conn. . . . . .
Wameco. See Waterbury Metal Wares Co.
Waterbury Co., Waterbury, Conn. . . . . B . . . . .
Waterbury Metal Wares Co., Waterbury, Conn. . . . S . .
Weber Brass Co., Whitney Power Block, Cleveland, O. B . . . . .
White Diamond. See White Mfg. Co., J. H.
White Mfg. Co., J. H., 111 N. 3rd, Brooklyn, N. Y. B . . S . .
Wilhite Machine Wks., 1245 S. Hope, Los Angeles, Cal. B . . . . .
Zamora. See American Pin Co.

FLASHERS, Sign
Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.
Ajax. See Reynolds Spring Co.
A. & W. See General Outdoor Adv. Co.
Angelus. See Electric Sign Flasher Corp.
Betts, Inc., James H., 1393 Sedgwick Ave., New York. (Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.)
Betts & Betts Corp., 645 W. 43rd, New York, N. Y. (Motor Flashers.) (Thermal Flashers.) Flashing Plugs.)
California Sign Flasher Co., 280 Guttenberg, San Francisco, Cal.
Cramblet Engineering Corp., 280 Guttenberg, Milwaukee.
Commercial Elec. Co., 1203 E. Grant, Portland, Ore.
Diamond. See General Appliance Corp.
Dominic. See Kala-Flasher Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electric Sign Flasher Corp., 1826 W. 9th, Los Angeles, Cal.
Figuregram. See Reynolds Electric Co.
Flash O-Lite. See Betts, Inc., James H.
Flip-Flop. See Betts, Inc., James H.
Gem Engineering Co., Hempstead, N. Y.
Gacor. See General Appliance Corp.
General Appliance Corp., 120 8th, San Francisco, Cal. (Flasher Button.)
General Controler Co., 200 E. First, Dayton, O.
Grazier Elec'l Products Co., Johnstown, Pa.
Horni Signal Mfg. Co., 292 Hudson, New York, N. Y.
Hotchkiss. See Cramblet Engineering Corp.
Jewel Elec. & Mfg. Co., 4505 Ravenswood Ave., Chicago, Ill.
Jimbetts. See Betts, Inc., James H.
Kala-Flasher Co., 344 N. Church, Kalamazoo, Mich.
Killark. See Betts & Betts Corp.
Kontroler. See General Controler Co.
Magnetic Sign Flasher Co., Seattle, Wash.
Mercury. See Betts, Inc., James H.
Opaluse Sign System, Battle Creek, Mich.
Phelps Elec. Co., 29 S. Clinton, Chicago, Ill. (Motorless)
Phoenix Products Co., Phoenix, N. Y.
Presto Products Co., 84 University Place, New York, N. Y. (Sockets and Plugs.)
Reco. See Reynolds Elec. Co.
Reynolds Elec. Co., 2650 W. Congress, Chicago, Ill.
Reynolds Spring Co., Jackson, Mich.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Ryan. See Phoenix Products Co.
Skedoodle. See Phelps Elec. Co.
Sokit. See Betts, Inc., James H.
Thermo-Wynk. See Betts & Betts Corp.
Vacu. See Betts & Betts Corp.
Veebar. See Betts, Inc., James H.
Way, Eugene W., Seattle, Wash.
Wood Electric Co., C. D., 565 Broadway, New York N. Y.
Woodwin. See Wood Elec. Co., C. D.
Wynk-A-Lyte. See Betts & Betts Corp.
FLASHLIGHT LENSES. See Lenses.
FLEXIBLE ARMS. See Tubing, Flexible Metallic.
FLEXIBLE LEADS, Commutater Brush. See Brushes, Commutator.
FLEXIBLE SHAFT. See Tubing, Flexible Metallic.

FORGINGS, Non-Ferrous
Scovill Mfg. Co., Waterbury, Conn.

FORMS, Coil Winding
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, O.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Master. See Armature Coil Equipment Co.

FORMS, Wire
Forms and Frames for Shade Holders and Shades: Bending, Welding, Forming.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Arrow Wire Frame Corp., 344 E. 23rd, New York, N. Y.
Blake & Johnson Co., Waterbury, Conn.
Central Wire Frame Co., 154 E. 23rd, New York, N. Y. (Complete with socket, cord and plug.)
Chelsea Wire Wks., 675 Hudson, New York, N. Y.
Clark Metal Products Inc., 490 Hancock Ave., Bridgeport, Conn.
Electro Weld Co., 70 Munroe, Lynn, Mass.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Jeschke Wire Specialty Wks., Crawfordsville, Ind.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Murray Hill Wire Frame Co., 314 E. 32nd, New York, N. Y.

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FRAMES, Wire. See Forms, Wire.
FRICTION TAPE. See Tape, Rubber and Friction.
FRINGE, Chandelier. See Crystals, Chandelier

FUSE CLIPS

Sherman Mfg. Co., H. B., Battle Creek, Mich.
FUSE TESTERS. See Testers, Fuse and Circuit.

FUSES AND FUSE WIRE

KEY

Cartridge ..... See C
Plug ..... See P
Non-Refillable ..... See N
Refillable ..... See R
Open Link ..... See O
Fuse Wire ..... See O

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. .. P .. .. ..
Arklass. See Economy Fuse Mfg. Co.
Arrow Electric Co., Hartford, Conn. .. P N .. ..
Automatic Elec. Iron & Fuse Co., 215 S. American, Philadelphia, Pa. .. P .. .. ..
Blue Ribbon. See Royal Elec. Co.
Buss. See Bussman Mfg. Co.
Bussmann Mfg. Co., University & Jefferson Ave., St. Louis .. C P N R O
Chase-Shawmut Co., Newburyport, Mass. .. C P N R O
Chicago Jefferson Fuse & Electric Co., 1505 W. 15th St., Chicago, Ill. .. C P N R O
Clearsite. See Economy Fuse & Mfg. Co.
Clear-Top. See Trico Fuse Mfg. Co.
Colortop. See Trico Fuse Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. (Automobile) .. C .. N R ..
Cote Bros. Mfg. Co., 182 W. Lake, Chicago C P .. R ..
Crystal. See Royal Elec. Co.
Daum Fuse & Elec. Mfg. Co., 1157 Hodgkiss, Pittsburgh .. C .. .. R ..
D. & W. See Graybar Electric Co.
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. .. C P N R ..
Eco. See Economy Fuse & Mfg. Co.
Electric Fuseguard Co., Charlottesville, Va.. C P N R ..
Elliott Electric Co., Shreveport, La. .. ..
Gem. See Chicago-Jefferson Fuse & Electric
General Electric Co., E. M. 12, Merchandise Dept., Bridgeport, Conn. .. C P N R ..
Graybar Electric Co., Graybar Bldg., Lexington Ave. and 43rd St., New York, N. Y. C .. ..
Great Western Fuse Co., 415 Lexington Ave., New York, N. Y. .. C .. .. R ..
H. & H. See Hart & Hegeman Mfg. Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. .. P .. R ..
Hudson Wire Co., Ossining, N. Y. .. .. O
Kantark. See Trico Fuse Mfg. Co.
Kirkman Engrg. Co., 1 Dominick St., New York, N. Y. .. C P N .. O
Littelfuse Laboratories, 1772 Wilson Ave., Chicago, Ill. (Low Capacity, Glass Enclosed, .025 to 2 Amp.) .. ..
Monarch Fuse Co., Jamestown, N. Y. .. C .. N R ..
National. See Economy Fuse & Mfg. Co.
Neark. See Colt's Patent Fire Arms Mfg. Co.
Pierce Renewable Fuses, Inc., 753 Main, Buffalo, N. Y. .. C P .. R ..
Platt Bros. & Co., Waterbury, Conn. .. .. O
Powell, F. W., 119 W. Ohio, Pittsburgh .. .. P .. R ..
Ree-Nu-It Elec. Co., New Bedford, Mass.. C P .. R ..
Rochester Re-Fill Fuse Co., 402 Cottage, Rochester, N. Y. .. C .. .. R ..
Royal Elec. Co., Chelsea Station, Boston.. .. P N .. ..
Shawmut. See Chase-Shawmut Co.
Simplicity. See Cote Bros. Mfg. Co.
Six-in-One. See Industrial Engrg. Co.
Star Fuse Co., 235 Canal, New York, N. Y. C P .. R ..
Trico Fuse Mfg. Co., 1001 McKinley Ave., Milwaukee .. C P N R ..
Union. See Chicago-Jefferson Fuse & Electric

GALVANIZING

Cattie & Bros., Joseph P., Gaul and Lotterly Sts., Philadelphia, Pa.
GALVANOMETERS. See Instruments, Laboratory Standard.

GAS INERT

Helium Co., Louisville, Ky.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.

GASKETS, Rubber

Gutta Percha & Rubber Mfg. Co., 15 Park Row, New York.
Canfield Rubber Co., Bridgeport, Conn.
GAUZE BRUSHES, Wire. See Brushes, Commutator.
GEARS, Fibre. See Gears and Pinions, Composition.

GEARS (Speed Changing Units)

Cleveland Worm & Gear Co., Cleveland, Ohio.
Cullman Wheel Co., 1346 Altgild, Chicago, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Ill.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Jones Fdy. & Machine Co., W. A., Chicago, Ill
Lipe, W. C., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Philadelphia Gear Works, Philadelphia, Pa.
Smith, Winfield H., Springville, N. Y.

GEARS, Worm

Albaugh-Dover Mfg. Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Colburn Gear & Mfg. Co. (Norfolk Downs), Quincy, Mass.
Philadelphia Gear Wks., Philadelphia, Pa.

GEARS AND PINIONS, Composition

Celoron Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Delaware.
Diamond State Fibre Co., Bridgeport, Pa.
Fabroil. See General Elec. Co.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago,
General Electric Co., Schenectady, N. Y.
Medart Co., St. Louis, Mo.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Stahl Gear Co., 1390 E. 40th, Cleveland, Ohio.
Stranahan Gear Co., Philadelphia, Pa.
Textoil. See General Electric Co.
Textolite. See General Electric Co.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND PINIONS, Iron and Steel

Earle Gear & Machine Co., Wayne Junction, Philadelphia.
Falk Corp., Milwaukee, Wis.

Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Meiart Co., St. Louis, Mo.
Meisel Bros. Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Perkins Machine & Gear Co., 120 Circuit Ave., Springfield, Mass.
Permag. See Perkins Machine.
Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

GEARS AND PINIONS, Rawhide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Gerdes & Co., 50 Church, New York, N. Y.
Syracuse Rawhide Mfg. Co., Syracuse, N. Y.
Western Rawhide & Belting Co., Milwaukee, Wis.
GENERATORS, Electroplating. See Plating Generators.
GLASS BULBS. See Bulbs, Glass.
GLASS CANDLES. See Candles, Fixture.
GLASS LETTERS. See Letters, Sign.

GLASS for Electrical Purposes

Corning Glass Wks., Corning, N. Y.
Pyrex. See Corning Glass Wks.

GLASSWARE

Alba. See Macbeth-Evans Glass Co.
Amazon. See Gleason-Tiebout Glass Co.
Amelites. See Consolidated Lamp & Glass Co.
Apollo. See Gillinder Bros., Inc.
Ardmore. See Jeannette Shade & Novelty Co.
Aurene. See Corning Glass Co.
Aurora. See Consolidated Lamp & Glass Co.
Bayley Sons, 105 Vanderveer, Brooklyn, N. Y.
Beaumont Co., Morgantown, W. Va.
Bellova. See McFaddin & Co., H. G.
Blanco. See Gleason-Tiebout Glass Co.
Beryllite. See Plaut & Co., L.
Camia. See Gleason-Tiebout Glass Co.
Carara. See Gleason-Tiebout Glass Co.
Celestialite. See Gleason-Tiebout Glass Co.
Clearcut. See Ivanhoe Division of Miller Co.
Colcite. See Corning Glass Co.
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Cora. See Consolidated Lamp & Glass Co.
Cora-Lites. See Consolidated Lamp & Glass Co.
Corning Glass Co., Corning, N. Y.
Cremax. See Macbeth-Evans Glass Co.
Crystal. See Phoenix Glass Co.
Daylite. See Wells Glass Co.
Decora. See Macbeth-Evans Glass Co.
Delica-White. See Kopp Glass, Inc.
Druid. See Ivanhoe Division of Miller Co.
Eagle Mfg. Co., Wellsburg, W. Va.
Emeralite. See McFaddin, H. G.
Equalite. See Bayley & Sons.
Erskine Glass & Mfg. Co., Wellsburg, W. Va.
Federal Light & Lens Corp., Star City, W. Va.
Florentine. See Gleason-Tiebout Glass Co.
Genco. See Ivanhoe Division of Miller Co.
Gillinder Bros., Inc., Port Jervis, N. Y.
Gillinder & Sons, Inc., Philadelphia, Pa.
Gleason-Tiebout Glass Co., 99 Commercial, Brooklyn, N. Y.
Gletieco. See Gleason-Tiebout Glass Co.
Havana. See Kopp Glass, Inc.
Hocking Glass Co., Lancaster, O.
Holophane Co., 342 Madison Ave., New York, N. Y.
Imperial Glass Co., Bellaire, O.
Inland Glass Works, Chicago, Ill.
Ivanhoe Division of Miller Co., Cleveland, Ohio.
Ivory. See Phoenix Glass Co.
Ivre. See Ivanhoe Division of Miller Co.
Jeannette Shade & Novelty Co., Jeannette, Pa.
Jefferson Glass Co., Follansbee, W. Va.
Kauffeld Glass & Ceramic Co., Star City, W. Va
King-Tutankhamen. See Macbeth-Evans Glass Co.
Kopp Glass, Inc., Swissvale, Pa.
Lumina. See Hocking Glass Co.
MacBeth-Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa.
Magnolia. See Phoenix Glass Co.
McFaddin & Co., H. G., 38 Warren, New York, N. Y.
Melilite. See Gillinder & Sons, Inc.
Micro. See Gillinder & Sons, Inc.
Miller Co., Meriden, Conn.
Monax. See Macbeth-Evans Glass Co.
Moonstone. See Jefferson Glass Co.
N. B. G. See Gillinder & Sons, Inc.
N. U. Glass. See Gillinder & Sons, Inc.
Nebulite. See Gillinder & Sons, Inc.
Nemalite. See Gillinder & Sons, Inc.
Nitro-Glas. See Jefferson Glass Co.
Nuart. See Imperial Glass Co.
Nulite. See Consolidated Lamp & Glass Co.
Nutralux. See Kopp Glass, Inc.
Opalux. See Gleason-Tiebout Glass Co.
Opola. See Inland Glass Co.
Pastelle. See Consolidated Lamp & Glass Co.
Pearltone. See Inland Glass Co.
Persian. See Gillinder & Sons, Inc.
Phoenix Glass Co., 230 Fifth Ave., New York, N. Y.
Pilabrasgo. See Kopp Glass, Inc.
Pittsburgh Cut Glass Co., Monaca, Pa.
Plaut & Co., L., 432 E. 23rd, New York, N. Y.
Poly-Case. See Gleason-Tiebout Glass Co.
Prestopal. See Gleason-Tiebout Glass Co.
Quezal Glass Mfg. Co., Fresh Pond Rd. and Metropolitan Ave., Brooklyn, N. Y.
Radiant. See Phoenix Glass Co.
Regent. See Ivanhoe Division of Miller Co.
Rezelle. See Ivanhoe Division of Miller Co.
Rosedora. See Consolidated Lamp & Glass Co.
Shade-O-Tone. See Consolidated Lamp & Glass Co.
Snow-White. See Inland Glass Works.
Star Glass Co., Star City, W. Va.
Sudan. See Ivanhoe Division of Miller Co.
Thebian. See Macbeth-Evans Glass Co.
Translux. See Kopp Glass, Inc.
Trojan. See Ivanhoe Div. of Miller Co.
United Novelty Glass Mfg. Co., 121 Prince, New York, N. Y.
Utopia. See Kopp Glass, Inc.
Velaria. See Ivanhoe Division of Miller Co.
Vineland Flint Glass Wks., Vineland, N. J.
Wells Glass Co., Kokomo, Ind.
Williamsburg Flint Glass Co., 290 Broadway, New York
Yural. See Ivanhoe Division of Miller Co.
Zanesville Mould Co., Zanesville, O.

GONGS, Unmounted Shells

Bevin Bros. Mfg. Co., East Hampton, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
East Hampton Bell Co., East Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
Hill Brass Co., M. N., East Hampton, Conn.
Reiter, G. C., Canton, O.
GRAPHITE BEARINGS. See Bearings, Oil-less.
GRID LEAKS. See Radio Circuit Components.
GRIDS, Resistance. See Units, Rods and Grids.
GRILL CLOTH. See Cloth, Untreated.
GROMMETS. See Eyelets.

GROUND LOCATORS. See Instruments, Portable and Switchboard; also Testers, Coil.
GROWLERS, Armature. See Testers, Coil.

HANDLES, Wood; For Switches or Sad Irons

Allen, Chas. E., Pequabuck, Conn.
American Ename Co., 20 Neville, Providence, R. I.
Bogert & Hopper, 225 Varick, New York, N. Y.
Estes & Son, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Fitchburg Enamel Co., Fitchburg, Mass.
Flanders Hardware Co., North Weare, N. H.
Fuller, J. J. Westfield, Mass.
Narragansett Mach. Co., Pawtucket, R. I.
National Wood Process, New Bedford, Mass.
Novelty Turning Co., Norway, Me.
Ober Mfg. Co., Chagrin Falls, O.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O
Piqua Handle & Mfg. Co., Piqua, Ohio.
Royal Enamel Co., Fitchburg, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Stiles & Co., H. A., 174 Portland, Boston, Mass.
Stratton Mfg. Co., Stratton, Maine.
Sun Enamel Wks., Leominster, Mass.
HOLDERS, Brush. See Brushes, Commutator.
HOT WIRE METERS. See Instruments, Portable and Switchboard.
ICE CREAM CABINETS. See Refrigerator Cabinets.
IMPREGNATING COMPOUNDS. See Wax and Compounds
IMPREGNATING, VACUUM. See Ovens, Industrial.
INCANDESCENT LAMP BULBS (Unfinished). See Bulbs, Glass.
INCANDESCENT LAMP FILAMENTS. See Filaments, Incandescent Lamp.

INDICATORS, Operation

Operation and Cost Indicators for Manager's Office.
Bristol Co., Waterbury, Conn. (Elapsed Time Recorder.)
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Production Meter Co., 1315 S. Wabash Ave., Chicago, Ill
INDUCTION COILS. See Coils, Finished.
INSTRUMENT, Jewels. See Jewels.
INSTRUMENTS, Laboratory Standard. See Instruments, Laboratory Standard.
INSTRUMENTS, Portable Testing. See Instruments, Portable and Switchboard; also Instruments, Pocket.

INSTRUMENTS, Laboratory Standard

Beck Bros., 3640 N. Second, Philadelphia, Pa.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Burt, R. C., 327 Michigan Ave., Pasadena, Cal. (Oscilloscopes.)
Cambridge Instrument Co., Ossining, N. Y.
Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill
Eppley Laboratory, Newport, R. I. (Standard Cells.)
Fahy. See Rubicon Co.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa
Hickok Elec'l Instrument Co., 10514 Dupont, Cleveland, O
Jagabi. See Biddle, James G.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kanson. See Rawson Elec'l. Instrument Co.
Kelvin. See Leeds & Northrup Co.
Kohlrausch. See Leeds & Northrup Co.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Milvay. See Chicago Apparatus Co.
Osiso. See Westinghouse Electric & Mfg. Co.
Radio Elec'l Wks., 50 W. 22nd, New York, N. Y.
Rawson Elec'l Instrument Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Simplex. See Leeds & Northrup Co.
Strobatchy. See Radio Elec'l Wks.
Thompson-Levering Co., 351 N. 57th St., Philadelphia, Pa
Vawter. See Thompson-Levering Co.
Unipivot. See Rawson Elec'l Inst. Co.
Vreeland Apparatus Co., 140 Cedar, New York, N. Y (Sine Wave Oscillators.)
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave. Newark, N. J.

INSTRUMENTS, Pocket

Advance. See Eldredge Elec'l Corp.
Adbro Mfg. Co., 927 French, Pittsburgh, Pa.
Eclipse. See Eldredge Elec'l Corp.
Eldredge Elec'l Corp., 3 P. O. Sq., Springfield, Mass
Ideal Instrument Co., Penacook, N. H.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Lundquist Tool & Mfg. Co., Worcester, Mass.
Manhattan Elec'l Supply Co., 17 Park Pl., New York, N. Y
Milavolt. See Adbro Mfg. Co.
Readrite Meter Works, 7 College Ave., Bluffton, Ohio.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Shire Elec. Products Co., Marquette Bldg., Detroit, Mich
Sholder-Excel Mfg. Co., Clyde, Ohio.
Square D Company, Detroit, Mich.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave Newark, N. J.
Wigginton. See Square D Company.
Yankee. See Lundquist Tool Mfg. Co.

INSTRUMENTS, Portable and Switchboard

This heading includes all standard, portable and switchboard types, measuring and testing instruments—ammeters, voltmeters, wattmeters, ohmmeters, cable testers and fault-finders.

See Also Instruments, Pocket; Also Instruments, Laboratory Standard.

Beck Bros., 421 Sedgley Ave., Philadelphia, Pa.
Beede Instrument Co., 136 Liberty, New York, N. Y.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne and Windrim Sts., Philadelphia, Pa.
Cambridge Instrument Co., Ossining, N. Y.
Dongan Electric Mfg. Co., 2985 Franklin, Detroit, Mich
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa
Electric Mfg. Co., 966 Mission, San Francisco, Cal.
Esterline-Angus Co., Speedway, Indianapolis, Ind.
Fidelity Electric Co., Lancaster, Pa.
Fisher Cable Test Sets. See Leeds & Northrup.
Fore Elecl. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo
Freyn Engrg. Co., 310 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa
Ground-Ohmer. See Sticht & Co.
Handy. See Weinberg & Co.
Hickok Elecl. Inst. Co., 10514 Dupont, Cleveland, O
Hoyt Elecl. Inst. Wks., 857 Boylston, Boston, Mass.
I T L. See Illinois Testing Laboratories.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa
Master. See Jewell Elecl. Instrument Co.
M. D. C. See Metropolitan Devices Corp.
Mazda Elec'l Supply Co., 870 Blue Island Ave., Chicago, Ill.
Megger Testing Sets. See Biddle.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn
Multi-Volt Trouble Finder. See Weiford, Jr., Geo. W.
Nagel Elecl. Co., W. G., 23 St. Clair, Toledo, Ohio.

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Paneltest Meters. See Beede Instrument Co.
Peerless Meters. See Thompson-Levering Co.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Pignolet Instrument Co., 76 Greenwich, New York, N. Y.
Pin-Jack. See Weston Elec'l Instrument Co.
Price Hollister Co., Rockford, Ill.
Radio Electric Works, 150 West 22nd St., New York, N. Y.
Rawson Elecl. Inst. Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sangamo Elec. Co., Springfield, Ill.
Shortfinder. See Eisemann Shortfinder Co.
Standee. See Sticht Co., H. H.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Tanner Engrg. Co., Rawson St. and Nelson Ave., Long Island City, N. Y.
Test-A-Bat. See Beede Instrument Co.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thomson. See General Electric Co.
Triplex Meters. See Roller-Smith Co.
3 in 1. See Sticht & Co., H. H.
Two-in-One. See Stitcht Co., Herman H.
United States Gauge Co., 44 Beaver, New York, N. Y.
Utility. See Esterline-Angus Co.
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.

INSULATION (Insulating) (Insulators)
Beads. See Beads, Insulating.
Canopy. See Insulators, Canopy.
Cloth. See Cloth & Paper.
Composition. See Molded Insulation.
Compound. See Wax and Comp.
Fibre. See Fibre.
Lava. See Cores, Resistance Coil.
Marble. See Slate.
Mica. See Mica.
Molded. See Molded Insulation.
Paint. See Paint and Varnish.
Paper. See Cloth and Paper Insulating.
Phenolic. See Fibre, Phenol. Also Molded Insulation.
Porcelain. See Porcelain.
Rod. See Rubber, Hard.
Rubber. See Rubber, Hard.
Sealing Wax. See Wax and Compounds.
Slate. See Slate.
Soapstone. See Soapstone.
Tubing. See Tubing, Varnished Fabrics.
Varnish. See Paint and Varnish.
Wax. See Wax and Compounds.

INSULATING MACHINES, WIRE. See Wire Manufacturing Machines.
INSULATING TUBING. See Tubing, Varnished Fabric; also Tubing, Rubber.

INSULATION CUTTERS
Artos Engrg. Co., Milwaukee, Wis.

INSULATION MIXERS
Baker Perkins Co., Saginaw, Mich.
INSULATION SHEARS. See Shears, Insulation.
INSULATION STRAINING MACHINES. See Wire Manufacturing Machines.
INSULATION TESTERS. See Instruments, Laboratory Standard.

INSULATORS, Canopy
Diamond State Fibre Co., Bridgeport, Pa.
General Electric Co., Schenectady, N. Y.
Knu. See Stanley, Arthur F.
Macallen Co., Macallen & Foundry, Boston, Mass.
Stanley, Arthur F. 150 Varick, New York, N. Y.
Wilmington Fibre Specialty Co., Wilmington, Del.

IRON CASTINGS. See Castings, Gray Iron.
IRONS, Soldering. See Soldering Irons.
JACKS, Armature. See Lifts, Armature.
JACKS, Radio. See Radio Receiver Parts.

JARS, Battery, Glass
For Composition Jars. See Molded Insulation; also Rubber.
Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
Gillinder & Sons, Inc., Philadelphia, Pa.
Hazel-Atlas Glass Co., Wheeling, W. Va.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa.
Rodefer Glass Co., Bellaire, O.
Sneath Glass Co., Hartford City, Ind.
United States Glass Co., 9th & Bingham, Pittsburgh, Pa.

JEWELS, Instrument Bearing
Bird, Richard H., Waltham, Mass.
Deknatel & Sons, J. A., Queens Village, N. Y.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Fisher, Thomas E., Penacook N. H.
Gatti, Inc., Aurele M., Liberty St. & Fairmount Ave., Trenton, N. J.
Moser Jewel Co., Perth Amboy, N. J.
Mildrum Jewel Co., East Berlin, Conn.
Sapphire Products Co., 51 Chambers, New York, N. Y.
Wennstrom's Sons Co., John, Suffern, N. Y.
Worley Jewel Co., John, Waltham, Mass.
Universal. See Oefinger, J. L.

JOINTS, Fixture Insulating
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.
Macallen Co., Macallen & Foundry, Boston, Mass.
Sandow Tool Co., 1440 Broadway, New York, N. Y.
Sprecher Mfg. Co., P. W., 3220 North Ave., Milwaukee.
White Co., W. C., 15 Hermon, Worcester, Mass.
Wittenberg Bros., 60 Shipman, Newark, N. J.

LABORATORY (Laboratories.)
Ovens. See Ovens, Industrial & Laboratory.
Rheostats. See Rheostats.
Testing. See Testing.

LABORATORY STANDARD INSTRUMENTS. See Instruments, Laboratory Standard.
LACQUER, ARMATURE. See Paint, Varnish and Lacquer.
Metal. See Paint, Varnish and Lacquer.
LAMINATIONS. See Discs, Armature.
LAMP BASES. See Bases, Reading Lamp.
LAMP BULBS (Unfinished). See Bulbs, Glass.
LAMP FILAMENTS. See Filaments, Incandescent Lamp.
LAMP LEAD-IN WELDS. See Filaments, Incandescent Lamp.
LAMP TESTING PHOTOMETERS. See Photometers, Lamp Testing.

LATHES
(Special for use in Motor Repairing and Motor Mfg.—Test Bench Lathes).
Ajax Electric Co., Kalamazoo, Michigan.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Cincinnati Lathe & Tool Co., 3207 Disney (Oakley) Cincinnati, Ohio.
Hobart Bros. Company, Troy, Ohio. (Test Bench).
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

LAVA. See Cores, Resistance Coil.
LEAD-IN WELDS, Lamp. See Filaments, Incandescent Lamp.
LEADS, FLEXIBLE (Commutator Brush). See Brushes, Commutator.

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Clinton Sign Co., Clinton, Ia.
Consolidated Lamp & Glass Co., Coraopolis, Pa. (Flashlight)
Corning Glass Wks, Corning, N. Y. (Flashlight and Signal.)
Deknatel & Sons, J. A., Queens Village, N. Y.
Gilligan Glass Products Co., New Philadelphia, Ohio.
Goerz American Optical Co., C. P., 317 E. 34th, New York.
Jefferson Glass Co., Follansbee, W. Va. (Sign and Flashlight.)
Kliegl Bros. Universal Stage Ltg. Co., 321 W. 50th, New York, N. Y. (Condensing and Projector.)
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa. (Flashlight.)
North Lights Co., 30 W. 15th, New York, N. Y.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.
Rochester Glass Products Co., 29 N. Water, Rochester, N. Y.
Rodefer Glass Co., Bellaire, O. (Flashlight.)
Sneath Glass Co., Hartford City, Ind. (Sign.)

LETTERS, Sign
Glass. Metal.
Adsign Corp, 113 W. 63rd, New York, N. Y.
Chain Products Co., 3924 Cooper Ave., Cleveland, O. (Brass and White Metal.)
Chicago Miniature Lamp Co., 652 W. Lake, Chicago, Ill. (Raised Letters for Signs.)
Eradium. See Pioneer Corporation.
Federal Elec. Co., 5700 S. State, Chicago, Ill. (Metal.)
Grammes & Sons, Inc., L. F., Allentown, Pa.
Heralite. See Pressed Prism Plate Glass Co.
Kolux Glass Sales Co., Kokomo, Ind.
Lu-Mi-Nus Signs, Inc., 2736 Wentworth Ave., Chicago, Ill.
Opalite Corp., 201 E. Ohio, Chicago, Ill.
Pioneer Corporation, 8308 Yale Ave., Chicago. (Luminous.)
Pressed Prism Plate Glass Co., Chicago, Ill. (Glass.)

LIFTS, Armature
Lifts, Hoists, Jacks, Trucks, Buggies, Floor Cranes.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Co., Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.

LININGS, Socket
Remington Mfg. Co., 937 Barnum Ave., Bridgeport, Conn.
LOCK WASHERS. See Washers, Lock.
LOOP WINDERS & SPREADERS. See Winding Machines, Armature & Field Coil.
LOUD SPEAKER DIAPHRAGMS MATERIAL. See Cloth, Untreated; also Parchment Paper.

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A. R. C. See American Reproducer Corp.
Amplion. See Woolf, J. W. & W. L.
Balsa Wood Reproducer Corp., 331 Madison Ave., New York.
Borkman Radio Corp., 152 E. Seventh, S. Salt Lake City, Utah.
Brielle. See Penn Mfg. Co.
Brooklyn Metal Stamping Corp., 720 Atlantic Ave., Brooklyn, N. Y. (Electric Pick-up.)
Cannonball. See Cannon & Miller Co.
Cannon & Miller Co., Springwater, N. Y.
Chelten Electric Co., 4859 Stenton Ave., Philadelphia, Pa.
Decatur Mfg. Co., 45 Harman St., Brooklyn, N. Y.
Dymac. See Electrical Products Mfg. Co.
Electrical Products Mfg. Co., Providence, R. I.
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill. (Units.)
Empire United Hat Block Co., 312 E. 42nd, New York.
Engineers Service Co., 25 Church, New York, N. Y. (Kit.)
Ensco. See Engineers Service Co.
Fenco Cone Co., 57 Murray, New York, N. Y. (Kit.)
Fergus Co., 235 Elizabeth Ave., Newark, N. J.
G. R. P. See Penn Mfg. Co.
Grutal Speaker Co., 609 E. Walnut, Des Moines, Iowa.
Jensen Radio Mfg. Co., 338 N. Kedzie Ave., Chicago, Ill.
Lata Isalsa. See Balsa Wood Reproducer Corp.
Magnavox Co., 4250 Horton, Oakland, Cal. Also Units.
Markone Radio Mfg. Co., 303 Devoe, Brooklyn, N. Y. (Horn.)
Miles Mfg. Co., 191 Joralemon, Brooklyn, N. Y.
Minuet. See Thompson Radio Co.
Molded Wood Products, 219 W. Chicago Ave., Chicago, Ill.
Mozart-Radiocelve. See Fergus Co.
Newcombe-Hawley, Inc., St. Charles, Ill.
Newton Elec'l Mfg. Co., Newton, Mass.
O'Neil Mfg. Corp., West New York, N. J.
Peerless. See United Radio Corp.
Penn Mfg. Co., G. R., 231 Mercer, New York, N. Y.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Philco. See Philadelphia Storage Battery Co.
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Powerola. See Temple Corp.
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Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Swoboda Co., Maritime Bldg., Seattle, Wash.
Temple Corp., 1925 S. Western Ave., Chicago, Ill.
Thompson Radio Co., 25 Church, New ...k, N. Y.
United Radio Corp., 25 Leighton Ave., Rochester, N. Y.
Universal. High Power Telephone Co., Carleton Ave. and Eddy, Seattle, Wash.
Utah Radio Products Co., 1615 S. Michigan Ave., Chicago, Ill. (Also Piano Unit.)
Victor Radio Corp., 4321 N. Western Ave., Chicago, Ill.
Vitalitone Radio Corp., 88 University Place, New York.
Wondrphone. See Universal High-Power Telephone Co.
Woolf J. W. & W. L., 227 Fulton, New York, N. Y.
Zisch Engineering Corp., Newark, N. J.

LUGS, Copper
Anderson Mfg. Co., Albert & J. M., 289 A St., Boston, Mass.
French Mfg. Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

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Luminous Compound .....See C
Pendants (Bulbs) .....See P
Standard Parts .....See S

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Bryant Electric Co., Bridgeport, Conn..... P
Connecticut Elec. Mfg. Co., Bridgeport, Conn..... S
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis.
Eagelite. See Eagle Elec. Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y..... P
General Electric Co., E. M. 12, Merchandise Dept., Bridgeport, Conn. ..... S P
Glow Lite. See Rodale Mfg. Co.
Glow Tip. See Arrow Electric Co.
Hart & Hegeman Mfg. Co., Hartford, Conn..... S P
Hubbell, Inc., Harvey, Bridgeport, Conn..... P
Luma & Luma Lite. See Radium Dial Co.
Radieye. See General Electric Co.
Radium Dial Co., 3532 Forbes, Pittsburgh, Pa.... C P
Reynolds Spring Co., Jackson, Mich..... S
Rodale Mfg. Co., 200 Hudson, New York, N. Y..... P
Seelite. See T. C. Smith & Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia .. P
Spot O Life. See Hart & Hegeman Mfg. Co.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y. ..... C S P

MACHINE SCREWS. See Screws, Machine.
MACHINE SCREW PRODUCTS. See Screw Machine Products.

MACHINES
Armature Banding. See Banding Machines, Armature.
Armature Notching. See Notching Machines, Armature.
Balancing. See Balancers, Armature.
Banding. See Banding Machines, Armature.
Cable Armoring. See Wire Manufacturing Machines.
Coil Shaping. See Shaping Machines, Coil.
Coil Taping. See Taping Machines, Coil.
Coil Winding. See Winding Machines.
Commutator Slotting. See Mica Undercutters.
Engraving. See Engraving Machines.
Incandescent Lamp Making. See Machines, Lamp Making.
Molded Insulation. See Presses, Molded Insulation.
Perforating. See Perforating Machines.
Porcelain Molding. See Presses, Porcelain Molding.
Radio Tube. See Machines, Lamp Making.
Shaping. See Shaping Machines, Coil.
Slotting. See Mica Undercutters.
Soldering. See Soldering Machines, Commutator.
Spring Making. See Spring Making Machines.
Taping. See Taping Machines, Coil.
Tension. See Tension Machines, Band Wire.
Winding. See Winding Machines.
Wire, Armoring. See Wire Manufacturing Machines.
Wire Drawing. See Wire Drawing Machinery.
Wire Insulator. See Wire Manufacturing Machines.
Wire Measuring. See Wire Manufacturing Machines.
Wire Tension. See Tension Machines, Band Wire.
Wire Wrapping. See Wire Wrapping Machines.

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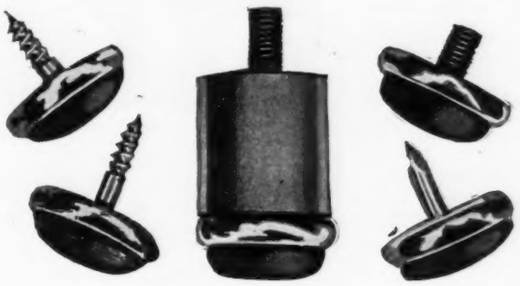
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Engineering & Supply Co., 160 5th Ave., New York, N. Y. Filament Winder.
Gesco. See General Engineering & Supply Co.
Sleeper & Hartley, Inc., Worcester, Mass.
York Elec. & Machine Co., 30 Penn, York, Pa.

MACHINES, Spring Making. See Spring Making Machines
MACHINES, WIRE MANUFACTURING. See Wire Manufacturing Machines.
MAGNET CHARGERS. See Chargers, Magnet.
MAGNET STEEL. See Steel, Magnet.
MAGNET TESTERS. See Instruments, Portable and Switchboard; also Instruments, Pocket.
MAGNET WIRE MACHINES. See Enameling Machines for Magnet Wire.
MAGNETIC CHUCKS. See Chucks, Magnetic.
MAGNETIC CLUTCHES. See Clutches, Magnetic.
MAGNETOMETERS. See Instruments, Pocket.

MAGNETS, Permanent
Bulleus Co., D. K., Pottstown, Pa.
Ind. Steel Products Co., 4545 S. Western Blvd., Chica
Rogers Drop Forging Co., Worcester, Mass.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
Sticht & Co., H. H., 13 Park Row, New
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.

MALLETS, Raw Hide
Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Crude Pelt. See Chicago Rawhide Mfg. Co.
Holbrook Raw Hide Mfg. Co., 748 N. Main, Providence, R. I.

MANGANESE, Battery. See Chemicals, Battery.
MEASURING INSTRUMENTS. See Instruments.
MECHANICAL RUBBER GOODS. See Rubber Mechanical Goods.
MEGOHMMETERS. See Instruments, Laboratory Standard.
MERCURY SWITCHES. See Switches, Mercury.
METAL CLEANERS (Compound). See Cleaners, Metal.
METAL CUTTING OUTFITS. See Welding and Cutting Outfits.
METAL FINISHING. See Plating & Finishing.
METAL MARKING OUTFITS. See Engraving Machines.
METALLIC SHADES. See Shades, Metallic.
METERS. See Instruments.



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Felt Feet

Make products like radio cabinets or battery eliminators shock-proof, and easier to handle without scratching or marring polished surfaces. Brawley felt feet are more permanent in their protection, for they will not deteriorate, harden or break off. Furnished with wood screws, machine screws or nails.

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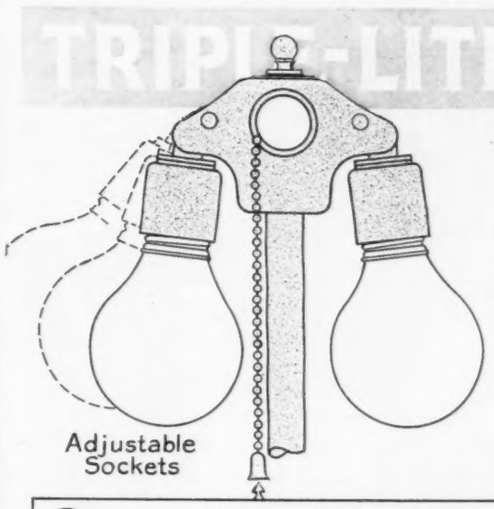
Brandywine FIBRE



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1st Pull *both lights bright*

2nd Pull *one light only*

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—an improvement in clusters that fixture manufacturers have been waiting for . . . . .

. . . . a triple-control switch that finds a most economical application to floor, table, ceiling, wall and bed lamps. It provides for three light changes without the use of resistance of any kind.

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MICA TAPE. See Tape, Mica.
MICA UNDERCUTTERS. See Slotting Machines & Tools, Commutator.

MICA

Asheville Mica Co., Biltmore, N. C.
Asco. See Schoonmaker Insulation Co.
Brand & Co., Wm., 268 Fourth Ave., New York, N. Y.
Chicago Mica Co., Valparaiso, Ind.
Colonial Mica Co., 136 Seventh, Jersey City, N. J.
Dielectric Mfg. Co., St. Louis, Mo.
Fillion., S. O., 68 Murray, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Gerdau Co., Otto, 14 Lispenard, New York, N. Y.
Hirsch Mica Co. 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
International Mica Co., 3680 Brandywine, Philadelphia, Pa
Kant Krack. See Huse Liberty Mica Co.
Keene Mica Co., Keene, N. H.
Macallen Co., Macallen and Foundry, Boston, Mass.
Micabond. See Chicago Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Micanite. See Mica Insulator Co.
Minerals & Insulation Co., 101 Spring, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Miralite. See Mitchell-Rand Mfg. Co.
Munsell & Co., Eugene, 200 Varick, New York, N. Y.
Nemco. See New England Mica Co.
New England Mica Co., Waltham, Mass.
New England Minerals, Inc., 85 Devonshire, Boston, Mass.
New York Mica & Mfg. Co., Auburn, N. Y.
Peerless. See New England Mica Co.
Prestonite. See Robt. K. Preston Mica Co.
Preston Mica Co., Robt. K., 957 Monadnock Blk., Chicago. (Ground Mica.)
Red Streak. See Huse Liberty Mica Co.
Rogers-Pyatt Shellac Co., 81 Water St., New York. (Imp.)
Schoonmaker Insulation Co., A. O., 34 University Place, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Watson Bros., 170 Purchase, Boston, Mass.

MINIATURE SWITCHBOARD SYSTEMS. See Instruments, Portable and Switchboard.

MIXERS, INSULATION. See Insulation Mixers.

MOLDED

Presses. See Presses, Molded Insulation.
Radio Parts. See Radio Molded Parts.

MOLDED INSULATION

Alco. See American Insulator Corp.
Allen & Hills, Inc., Auburn, N. Y.
American Insulator Corp., 420 Lexington Ave., New York.
American Machine & Foundry Co., 5520 Second Ave., Brooklyn, N. Y.
Amerine. See American Insulator Corp.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Asbestos Shingle Slate & Sheathing Co., Ambler, Pa. (Cold.)
Auburn Button Wks., Auburn, N. Y.
Bakelite Corp., 247 Park Ave., New York, N. Y.
Bay State Moulding Co., 1197 Dorchester Ave., Boston.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldenmold. See Belden Mfg. Co.
Bell Mfg. Co., 11 Elkins, Boston, Mass. Radio Parts.
Boonton Molding Co., Boonton, N. J.
Boonton Rubber Mfg. Co., 223 Fanny Rd., Boonton, N. J.
Brr-lite Moulding Corp., 109 Hudson, Jersey City, N. J. (Wood Composition.)
Celoron Co., Bridgeport, Pa.
Cetelite. See Connecticut Molded Products Corp.
Cetee. See Connecticut Molded Products Corp.
Cepco. See Connecticut Molded Products Corp.
Coltrock. See Colt's Patent Firearms Mfg. Co.
Charmond Elec. Corp., 30 Church, New York, N. Y.
Chicago Molded Products Co., 2149 Walnut, Chicago, Ill.
Cincinnati Molding Co., 2037 Florence Ave., Cincinnati, O.
Colasta Co., Hoosick Falls, N. Y.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site, Inc., 207 Astor, Newark, N. J.
Condenalite. See Bakelite Corp.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Molded Products Corp., Meriden, Conn. (Cold.)
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Dayton Insulating Molding Co., 434 E. First, Dayton, Ohio.
Diemoulding Production Co., Canastota, N. Y.
Dimec. See Dayton Insulating Moulding Co.
Durez. See General Plastics, Inc.
Electrose. See Insulation Mfg. Co.
Erinold Co., Park Row Bldg., New York, N. Y.

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1025 Mill St., Lockport, N. Y.

Evercool. See Bakelite Corp.
Federal Insulating Corp., Yonkers, N. Y.
Fedrelin. See Federal Insulating Corp.
Formica Insulation Co., 4628 Spring Grove Ave., Cincinnati, O.
Garfield Mfg. Co., Garfield, N. J. Composition. (Cold.)
General Electric Co., Schenectady, N. Y.
General Moulded Composition Co., 212 Market, Lynn, Mass.
General Plastics, Inc., 116 Walck Rd., N. Tonawanda, N. Y.
Gummor. See Garfield Mfg. Co.
Hahn Mfg. Co., Harry W., 623 S. San Pedro, Los Angeles, Cal.
Herculite. See Colonia Co.
Huetter-Premier Machine Co., 7215 Livernois Ave., Detroit, Mich.
Hi-Heet. See Insulation Mfg. Co.
Imperial Molded Products Co., 2925 W. Harrison, Chicago.
Imptoco. See Insulation Products Co.
Inda. See American Machine & Foundry Co.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Insulation Products Co., 404 Richland, Pittsburgh, Pa.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
International Insulating Corp., Elyria, O.
Isolantite Co. of America, Inc., Sellville, N. J.
Johnson Molding & Tool Co., Weymouth, Mass.
Karolith Corp., 189 13th, Long Island City, N. Y. (Casein plastics.)
Kellite. See Kellogg Switchboard & Supply Co.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Keystone Specialty Co., 2373½ Coventry Rd. (Lakewood), Cleveland, O.
Klagges, Chas., 128 147th, Ozone Park, N. Y.
Kuhn & Jacob Machine & Tool Co., 502 Prospect Ave., Trenton, N. J.
Kurz-Kasch Co., Dayton, O.
Lacanite. See Scranton Button Co.
Macallan Co., Macallan and Foundry Sts., Boston, Mass.
Mack Molding Co., Little Falls, N. J.
Makalot. See Johnson Molding & Tool Co.
Manchester Mfg. Co., Manchester Depot, Vt.
Megohom. See Waterbury Button Co.
Micarta Fabricators, Inc., 309 Canal, New York, N. Y.
Micarta. See Westinghouse Elec. & Mfg. Co.
Modern Molded Products Co., Blount and Elm Sts., Providence, R. I.
New England Products Co., 233 Greenwich, New York, N. Y.
Niagara Insul-Bake Specialty Co., 483 Delaware Ave., Albany, N. Y.
Nixon Nitration Works, Nixon, N. J.
Nixonoid. See Nixon Nitration Works.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Norloc. See Norton Laboratories, Inc.
Northern Industrial Chemical Co., 11 Elkin, South Boston
Norton Laboratories, Inc., 1025 Mill, Lockport, N. Y.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Paramix. See Splitdorf Radio Corp.
Paratherm. See Scranton Button Co.
Phenolic. See Scranton Button Co.
Pruven Compositions Products Corp., Milford, Conn.
Pruvenite. See Pruven Composition Products Co.
Pyrolax. See Cutler-Hammer Mfg. Co.
Recto Mfg. Co., 23 W. 3rd, Cincinnati, O.
Redmonol. See Bakelite Corp.
Rexlite. See Northern Industrial Chemical Co.
Reynolds Spring Co., Jackson, Mich.
Reynoldite. See Reynolds Spring Co.
Reynomold. See Reynolds Spring Co.
Richardson Co., Lockland, Cincinnati, O.
Ridgelite. See Ridgley Trimmer Co.
Ridgley Trimmer Co., Springfield, O.
Schneider Bros., Inc., 304 N. Sheldon Ave., Chicago.
Scranton Button Co., Scranton, Pa.
Shaw Insulator Co., Irvington, Newark, N. J.
Siemon Co., State and Dewey, Bridgeport, Conn.
Specialty Insulation Mfg. Co., Hoosick Falls, N. Y.
Star Insulate. See Insulation Mfg. Co.
Starite. See Insulation Mfg. Co.
Stokes & Smith Co., Summerdale Ave. near Roosevelt Blvd., Philadelphia, Pa.
Textolite. See General Elec. Co.
Thermoplax. See Cutler-Hammer Mfg. Co.
Tegit. See Garfield Mfg. Co.
Union Insulating Co., Parkersburg, W. Va.
Vulcabeston. See Colt's Patent Fire Arms Mfg. Co.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.
Waterbury Button Co., Waterbury, Conn.
Watertown Mfg. Co., Watertown, Conn.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

MOLYBDENUM

Elkon, Inc. (Div. of P. R. Mallory Co.), Portchester, N. Y.
Lohfeld & Co., J. L., 53 Park Place., New York, N. Y.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.
Radiotherma, Inc., 45 E. 17th, New York, N. Y.

MONEL METAL

International Nickel Co., 67 Wall, New York, N. Y.

MOTOR CONTROLLERS. See Controllers, Motor.
MOTOR PLATFORM BASES. See Bases, Motor Platform.
MOTOR STARTERS. See Controllers, Motor; Switches, Remote Control; Switches, Motor Starting; Safety; Switches, Snap (Heavy Duty).

MOTORS

Alternating Current ..... See S
Direct Current ..... See S
Motors, 1 Hp. up ..... See M
Motors Fractional Hp. ..... See F
Universal ..... See U

Acme Elec. & Mfg. Co., 1653 Rockwell, Cleveland M . . . . .
Actodector. See Roth Bros. & Co.
Advance Elec. Co., 4311 Maple Ave., St. Louis M F S . .
Allis-Chalmers Mfg. Co., Milwaukee, Wis..... M . . S . .
Allis Co., Louis, Milwaukee, Wis..... M . . S . .
American Elec. Motor Co., Cedarburg, Wis..... M . . . . .
Apex Elec'l Mfg. Co., 1067 E. 152nd, Cleveland . . F S U
Armor Elec. Mfg. Co., 1020 Holland, Erie, Pa. M . . . . .
A. R. S. See Westinghouse Elec.
Baldor Elec. Co., 4352 Duncan Ave., St. Louis M F S . .
B-Line. See Brown-Breckmeyer Co.
Bodine Elec. Co., 2254 Ohio, Chicago..... . . F S U
Bogue Elec. Co., Chas. J., 132 King, New York M . . . . .
Brown-Brockmeyer Co., Norwood Power Bldg., Dayton, O..... M F . . .

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B. T. See Allis Co., Louis.
B & R Mfg. Co., 812 Lafayette, Toledo, O..... . . F . . .
Cah. See Westinghouse Elec. Mfg. Co.
Century Elec. Co., 1806 Pine, St. Louis, Mo.. M F S . .
Chandeysson Elec. Co., St. Louis, Mo..... M . . S . .
Clark, Jr., Elec. Co., James, 600 E. Bergman, Louisville, Ky..... M . . . . .
Cleveland Armature Wks., 4732 St. Clair Ave., Cleveland, O. ..... M . . S . .
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J. M . . S U
Cushman Elec. Co., Concord N. H..... M F S . .
Day-Fan Electric Co., Dept. A, Dayton, O..... . . F S . .
Diehl Mfg. Co., Elizabeth, N. J..... M F S . .
Diverter Pole. See Rochester Elec. Product Co.
Domestic Electric Co., 7209 St. Clair Ave., Cleveland, O. .... S U
Dumore. See Wisconsin Elec. Co.
Eclipse. See Fidelity Elec. Co.
Electric Machinery Co., Minneapolis, Minn.. M . . S . .
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. ..... M . . . . .
Electric Specialty Co., 221 South Stamford, Conn. M F S U
Electro-Dynamic Co., Bayonne, N. J..... M . . S . .
Emerson Electric Mfg. Co., 2015 Washington Ave., St. Louis, Mo..... M F S U
Engberg's Elec. & Mechl. Works, St. Joseph, Mich. ..... M . . S . .
Esco. See Electric Specialty Co.
Fairbanks-Morse & Co., Chicago, Ill..... M F . . .
Fidelity Elec. Co., Lancaster, Pa..... M F S U
Fitzgerald Mfg. Co., Torrington, Conn..... . . F . . .
Fynn Weichsel. See Wagner Elec. Corp.
Galvin Elec. Mfg. Co., 3314 S. Broadway, St. Louis, Mo. ..... F . . S . .
General Elec. Co., Schenectady, N. Y..... M F S U
Gilbert Co., A. C., New Haven, Conn..... . . F . . U
Hamilton Beach Mfg. Co., Racine, Wis..... . . F S U
Hobart Bros. Co., Troy, O..... M . . S . .
Holtzer-Cabot Elec. Co., 125 Amory, Boston... M F S . .
Howell Elec. Motors Co., Howell, Mich..... M . . S . .
Ideal Elec. & Mfg. Co., Mansfield, O..... M . . S . .
Imperial Electric Co., Akron, O..... M . . S . .
Janette Mfg. Co., 556 W. Monroe, Chicago..... . . F S . .
Jantz & Leist Elec. Co., Cincinnati, O..... M F . . .
Jeanin Electric Co., Toledo, O..... M F S . .
Kendrick & Davis Co., Lebanon, N. H..... . . F S . .
Kimble Elec. Co., 634 N. Western Ave., Chicago M . . S U
Knapp Elec., Inc. (Div. of P. R. Mallory & Co.), Port Chester, N. Y..... . . F S U
Leland Elec. Co., Dayton, O..... . . F S . .
L. E. See Leland Elec. Co.
Lincoln Elec. Co., Cleveland, Ohio..... M . . S . .
Line-Weld. See Lincoln Elec. Co.
Linzee Elec. Motor Co., Mansfield, O..... M . . . . .
Mando Co., Syracuse, N. Y..... . . F . . . .
Marathon Elec. Mfg. Co., 32 Island, Wausau, Wis. . . F . . . .
Marble-Card Elec. Co., Gladstone, Mich..... M . . . . .
Master Electric Co., Linden and Master Aves., Dayton, O. ..... M F S . .
MC. See General Electric Co.
Michigan Elec. & Mfg. Co., Lake Linden, Mich. . . F S . .
N. C. See Electric Controller & Mfg. Co.
Norfolk. See Walter Elec. Mfg. Co.
North East Elec. Co., Rochester, N. Y..... . . F . . U
Northwestern Mfg. Co., 480 Clinton, Milwaukee M . . . . .
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio .... F S . .
O. K. See Marathon Elec. Mfg. Co.
Osann Co., F., 245 Seventh Ave., New York M . . . . .
Peerless Elec. Co., 740 W. Market St., Warren, O. M F S U
Polar Cub. See Gilbert Co., A. C.
Pow-R-Full. See Wagner Elec. Corp.
Ra-Lite. See Acme Elec. & Mfg. Co.
Reco. See Reynolds Electric Co.
Red Band. See Howell Elec. Motors Co.
Reliance Elec. & Engrg. Co., 1042 Ivanhoe Rd., Cleveland, O. ..... M . . S . .
Reynolds Electric Co., 2650 W. Congress, Chicago . . F S . .
Robbins & Myers, Inc., Springfield, O..... M F S U
Rochester Elec Products Corp., Rochester, N. Y. M . . S . .
Roth Bros. & Co., Chicago, Ill..... M . . S . .
Standard. See Robbins & Myers Co.
Star Elec. Motor Co., Miller St. & N. J. R. R. Ave., Newark, N. J..... M . . S . .
Sterling Elec. Motors, Inc., Telegraph Rd. and Atlantic Blvd., Los Angeles, Cal..... M . . S . .
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Sunlight Electrical Mfg. Co., Warren, O..... F S
Super Wick. See Master Elec. Co.
Switch start. See Lincoln Elec. Co.
Triumph Elec. Corp., Carthage, O..... M S
Union Elec. Motor Mfg. Co., Hancock & Oxford Sts., Philadelphia, Pa..... M F S
U. S. Elec. Mfg. Co., 200 E. Slawson Ave., Los Angeles ..... M S
Valley Elec. Co., 4221 Forest Park Blvd., St. Louis, Mo. ..... M S
Wagner Elec. Corp., 6400 Plymouth Ave., St. Louis, Mo. ..... M F S U
Walter Elec. Mfg. Co., Norfolk, Va..... M S
Watson. See Allis Co., Louis.
Welco Uniframe. See Wesche Elec. Co., B. A.
Wesche Elec. Co., B. A., 1622 Vine, Cincinnati M F S
Westinghouse Elec. Mfg. Co., East Pittsburgh M F S
Willey-Wray Elec. Co., Cincinnati, O..... M S
Wisconsin Elec. Co., 59 16th, Racine, Wis..... F U
Woods Mach. Co., S. A., Boston..... M F S
Zobell Elec. Motor Co., Garwood, N. J..... M S

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Angell Embossing Co., 37 Barney-Smith Co., Dayton, O.
Celoron Co., Bridgeport, Pa.
Chandler Co., Springfield, Mass.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Electro-Chemical Engraving Co., 52 Vanderbilt Ave., New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y.
Etching Co. of America, 1520 Montana, Chicago, Ill.
General Etching & Mfg. Co., 3070 W. Grand Ave., Chicago, Ill.
Grammes & Sons Inc., L. F., Allentown, Pa.
Premier Metal Etching Co., 14th & Van Alst Ave., Long Island City, N. J.
Waterbury Button Co., Waterbury, Conn.

NICKEL

American Mond Nickel Co., Century Bldg., Pittsburgh, Pa.
Driver-Harris Co., Harrison, N. J.
International Nickel Co., 67 Wall, New York, N. Y.
Seymour Mfg. Co., Seymour, Conn.
United States Nickel Co., New Brunswick, N. J.

NOTCHING MACHINES, Armature

Ferracute Machine Co., Bridgeton, N. J.

NUT SETTING MACHINES

Vim Tool Co., 149 Broadway, New York, N. Y.

OHMMETERS. See Istruments, Laboratory Standard; also Instruments, Portable and Switchboard.
OIL-LESS BEARINGS. See Bearings, Oil-less.
OSCILLOSCOPES. See Instruments, Laboratory Standard.

OVENS, Industrial and Laboratory

Annealing, Temper Drawing, Mold Baking, Vulcanizing, Drying, Conditioning, Enameling, Japanning, Vacuum Impregnating.
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Crawford Oven Co., New Haven, Conn. (Coil Driers.)
Despatch Oven Co., 120 First Ave., N., Minneapolis, Minn.
Detroit Sheet Metal Wks., 1341 E. Milwaukee Ave., Detroit, Mich.
Devine Mfg. Co., J. P., Buffalo, N. Y.
Eberbach & Son Co., Ann Arbor, Mich. (Drying.)
Electric Heat Control Apparatus Co., 245 New Jersey R. R. Ave., Newark, N. J.
Emerson Apparatus Co., Melrose, Mass. (Conditioning.)
Freas. See Thermo Elec. Instrument Co.
Gehnrich Indirect Heat Oven Co., Long Island City, N. Y.
General Electric Co., Schenectady, N. Y.
Hayes, C. I., 129 Baker, Providence, R. I.
Heidbrink Co., 2633 Fourth Ave., S., Minneapolis, Minn.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Kenworthy, Chas. F., 198 Piedmont, Waterbury, Conn.
Mashler Co., Paul, 2210 Lake, Chicago, Ill.
Miho Co., 717 Sycamore, Cincinnati, O.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Sargent & Co., E. H., Chicago, Ill.
Sioux Battery & Mfg. Co., Sioux City, Ia. (Battery.)
Snead & Co., Jersey City, N. J.
Standard Elec. Stove Co., Toledo, Ohio.
Steiner & Co., H. E., 197 E. Kinney St., Newark, N. J.
Stokes Machine Co., F. J., 5826 Tabor Rd., Philadelphia, Pa.
Swartwout Co., 18523 Euclid Ave., Cleveland, O.
Thermo Elec. Instrument Co., 1206 Grove, Irvington, N. J.
Vacuum Impregnating Wks., 626 Federal, Chicago, Ill. (Impregnating).
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Young Bros. Co., 6500 Mack, Detroit, Mich.

OXIDES, Battery. See Chemicals, Battery.

PACKING

Cooke Seal Ring, Dept. I, 46 N. Green St., Chicago, Ill.
Federal Metallic Packing Co., Wakefield, Mass.
Packtite. See Federal Metallic Packing Co.

PAINT, Varnish, Lacquer

KEY
Varnishes, Insulating .....See V
Painting, Dipping, Spraying, Vacuum Impregnating.
Paint, Insulating and Acid Proof..See P
Lacquer, Metal Finishing .....See L
Acme White Lead & Color Wks., 8250 St. Aubin Ave., Detroit, Mich. L
Ajax. See Sherwin-Williams Co.
Alaka. See Lacquer & Chemical Corp.
American Di-Electrics, Ltd., Hancock and Bodine, Long Island City, N. Y. V
American Lastite Co., 3166 Lincoln Ave., Chicago.. P L
Antakwa Co., 1329 Mohawk, Chicago, Ill..... P
Arizona Lacquer Mfg. Co., 7 16th, Brooklyn, N. Y. L
Armlac. See Robertson Chemical Co.
Arolac. See Arizona Lacquer Mfg. Co.
Art-Craft. See Southwestern Paint & Varnish Co.
Atlantic Chemical Co., Coit, Irvington, N. J..... L
Atom Chemical Co., 96 E. 10th, New York, N. Y..... L
Bakelite Corp., 247 Park Ave., New York, N. Y..... L
Belden Mfg. Co., 2310B, S. Western Ave., Chicago
Benolite Varnish Co., Pittsburgh..... V P
Berry Bros., Leib & Wight, Detroit, Mich..... V
Billings-Chapin Co., 1163 E. 40th, Cleveland, O.. V
Biwax Corp., 208 S. La Salle, Chicago, Ill..... P L
Bradley-Hurts Co., 2626 S. Dearborn, Chicago, Ill. L
Brevolite. See Waukegan Chemical Co.
Calman & Co., Emil, 42 Vernon Blvd., Long Island City, N. Y. ..... V P
Carboloid Products Corp., 15 Park Row, New York, V P
Chinalac. See Dolph Co., John C.
Coehrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. ..... V P
Code 25. See Mitchell-Rand Mfg. Co.
Columbus Varnish Co., 264 Cozzeins, Columbus, O. V
Comulac. See Martindale Elec. Co.
Dolph Co., John C., 168 Emmet, Newark, N. J.. V P
Duco. See Du Pont de Nemours & Co.
Du Pont de Nemours & Co., Wilmington, Del.... P
Eastman Kodak Co., Rochester, N. Y..... L
Eclipse Paint & Mfg. Co., Cleveland, O..... P
E. B. See Mitchell-Rand Mfg. Co.
Egyptian Lacquer Mfg. Co., 90 West, New York.. L
Electric Lacquer. See Dolph Co., John C.
Enamelac. See Robertson Chemical Co.
Ever-Brite Products Co., East Liverpool, O..... L
Federal Insulating Corp., Yonkers, N. Y..... V P
Flex-ib-lac. See Dielectric Mfg. Co.
Franche & Co., 440 Orleans, Chicago, Ill..... L
General Elec. Co., E. M. 12, Merchandise Dept., Bridgeport, Conn. ..... V P
General Plastics, Inc., 116 Walck Rd., N. Tonawanda, N. Y. V
George Co. P. D., St. Louis, Mo..... V
G. E. See General Elec. Co.
Glidden Co., Cleveland, O..... V P L
H. B. See Maas & Waldstein Co.
Hilo Varnish Corp., Marcy & Flushing Aves., Brooklyn, N. Y. ..... V P L
Impervious Varnish Corp., 421 Wood, Pittsburgh. V P
Insulaterite. See Ohmlac Paint & Refining Co.
Insulvar. See Varflex Corp.
Irvington Varnish & Insulator Co., Irvington, N. J. V P L
Kodalak. See Eastman Kodak Co.
Krakles. See Waukegan Chemical Co.
Lacquer & Chemical Corp., 214-40th St., Brooklyn, N. Y. ..... P L
Laqueroid. See Glidden Co.
Liberty. See Antakwa Co.
Linolac. See Mica Insulator Co.
Lowe Bros. & Co., 450 E. 3rd, Dayton, O..... V P
Lucas & Co., John, 322 Race, Philadelphia, Pa.. V P
Lucote. See Lucas & Co., John.
Maas & Waldstein, 438 Riverside Ave., Newark, N. J. L
McDougall-Butler Co., Inc., Evans Water & Norton, Buffalo, N. Y. ..... V P
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O. V
Mawalac. See Maas & Waldstein.
Mecco. See Henry V. Walker Co.
Mica Insulator Co., 200 Varick St., New York.... V
M. I. C. See Mica Insulator Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. V P
Nikolas & Co., G. J., 1227 W. Van Buren, Chicago. L
O'Brien Varnish Co., South Bend, Ind..... V P L
Ohmlac Paint & Refining Co., 140 S. Dearborn, Chicago, Ill. ..... P
Opex. See Sherwin-Williams Co.
Ozite. See Standard Underground Cable Co.
P. & B. See Ruberoid Co.
Pacoria Paint Co., 4th & Sedgeley Ave., Philadelphia, Pa. L
Pedigree. See George Co. P. D.
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Peerless. See Maas & Waldstein Co.
Proxlin. See Acme White Lead & Color Wks.
Pruett-Schaeffer Chemical Co., Taber, Pittsburgh. P L
Reliable Leather Dressing Co., 43 Crescent, Long Island City, N. Y. V
Republic Varnish Co., 200 Thomas, Newark, N. J. V
Robertson Chemical Co., 9805 Meech Ave., Cleveland, O. ..... V P
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Rockbestos Products Corp., New Haven, Conn..... V
S. P. C. See Ruberoid Co.
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Standard Flexible Comp. Co., Franklin Trust Bldg., Philadelphia, Pa. ..... V P
Standard Insulation Co., Rutherford, N. J..... V
Standard Lacquer Co., 621 Broadway, New York, N. Y. L
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa..... P
Standard Varnish Wks., 443 4th Ave., New York. V P L
Sterling Varnish Co., Haysville, Pa..... V P L
Toch Bros., 443 4th Ave., New York..... V P L
Truscon Laboratories, Canfit & Grand Trunk Railway, Detroit, Mich. V
2098. See Mitchell-Rand Mfg. Co.
Varflex Corp., Rome, N. Y..... V
Voltax Co., 99 Reservoir Ave., Bridgeport, Conn. V P
Vulcan-Lastite. See American Lastite Co.
Walker Co., Henry V., 17 John St., New York..... L
Walpole. See Robertson Chemical Co.

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Zellac. See Zeller Lacquer Mfg. Co.
Zeller Lacquer Mfg. Co., 20 E. 49th, New York..... L

PANELS (panel) Engraving. See Engraving.
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Radio (Hard Rubber) See Rubber Hard.
Meters. See Instruments, Portable & Switchboard.

PAPER

Boxes. See Boxes & Wrappers.
Bushings. See Tubes, Paper.
Candles. See Candles, Fixture.
Cores. See Tubes, Paper.
Fibre. See Cloth and Paper.
Fish. See Cloth & Paper.
Insulating. See Cloth and Paper.
Parchment. See Parchment Paper.
Shades. See Shades, Fabric.
Sleeves. See Tubes, Paper.
PARAFFINE. See Wax and Compounds.

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Anaconda. See American Brass Co.
Elephant Brand. See Phosphor-Bronze Smelting Co.
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Kino-Lamp. See Raytheon Mfg. Co.
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Burke Elec. Co., Erie, Pa.
Chandeysson Elec. Co., St. Louis, Mo.
Connecticut Dynamox Motor Co., Irvington, N. J.
Conpro. See Eager Elec. Co.
Eager Electric Co., 523 Newell, Watertown, N. Y.
Eclipse. See Fidelity Elec. Co.
Electric Specialty Co., 229 South, Stamford, Conn.
Esco. See Electric Specialty Co.
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Hanson-Van Winkle-Munning Co., Matawan, N. J.
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PLUG FUSES. See Fuses and Fuse Wire.
PLUG RECEPTACLES. See Receptacles, Plug.
PLUGS, Flashing. See Flashers, Sign.
PLUGS, Radio. See Radio Receiver Parts.

PLUGS, Attachment

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Eagle Elec. Mfg. Co., Dept. EH4, 50 Hall, Brooklyn, N. Y.
Eastman Mfg. Co., Manitowoc, Wis.
Electric Co., 94 Allyn, Hartford, Conn.
Ericson Mfg. Co., 3257 Bradford Rd., Cleveland, O.
Esler Elec. Mfg. Co., 802 S. Adams, Marion, Ind.
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Fitzall. See Rodale Mfg. Co.
Gaynor Elec. Co., Inc., Stratford Ave., Bridgeport, Conn.
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Snoco. See Snow & Co., E. W
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Un-X-Ld. See Speedway Elec'l Mfg. Co.
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Weber. See Sears, Henry D.
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Wilshires. See Iona Co.
Yankee. See Beaver Mfg. Co.

POCKET METERS. See Instruments, Pocket.

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Spark-O-Metal. See Hardy Metal Corp.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J. (Platinum and Silver.)

POLARITY INDICATORS. See Instruments, Pocket.
POLISHING MACHINES, WIRE. See Wire Polishing Machines.

PORCELAIN
Liquid. See Cement, Liquid Porcelain.
Molding Machine. See Presses, Porcelain Molding.
Reflectors (Enameled). See Reflectors, Porcelain Enameled
Refractory. See Cores, Resistance Coil.

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A. P. See Akron Porcelain Co.
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Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
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Hartford Faience Co., Hartford, Conn.
Hub-Way Mfg. Co., Hubbard, Ohio.
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Metsch Refractories Co., East Liverpool, Ohio
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Porcelava. See Burgess & Co.
Porcelain Products, Inc., Findlay, Ohio.
Square D Company, Detroit, Mich.
Standard Porcelain Co., Leetonia, O.
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Star Porcelain Co., Muirhead St., Trenton, N. J.
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Chase Brass & Copper Co., Waterbury, Conn.
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Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
King. See Morse Co., Frank W.
Morse Co., Frank W., 289 Congress, Boston. (Spring Grip.)
Nutmeg. See Hart & Hegeman Co.
Premier Elec. Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
Queen. See Morse Co., Frank W.
Thomaston Mfg. Co., Thomaston, Conn.
Waterbury Button Co., Waterbury, Conn.

POTENTIOMETERS (Instruments). See Instruments, Laboratory Standard.
POTENTIOMETERS (Radio Control). See Radio Receiver Parts.
POWDERED CARBON. See Carbon, Powdered.
POWER TRANSMISSION CHAIN. See Chain, Power Transmission.
PRESS BOARD. See Cloth and Paper.

PRESSES, Armature Coil

Comstock Mfg. Co., Wilkes-Barre, Pa.

PRESSES, ARMATURE NOTCHING. See Notching Machines, Armature.

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Watson-Stillman Co., 75 West St., New York, N. Y
Wood & Co., R. D., Florence, N. J.

PRESSES, Porcelain Molding

Baird, Andrew, 2715 Newark, Detroit, Mich

PRESSES, Punching

Bench Presses—Power Presses; for Punching & Stamping Sheet Metal.
Ams Machine Co., Max, 101 Park Ave., New York, N. Y.
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., 53rd St. & Second Ave., Brooklyn, N. Y.
Dunning & Boschert Press Co., 329 W. Water, Syracuse N. Y.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hyro Mfg. Co., 200 Varick, New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.

PRISMS, Chandelier. See Crystals, Chandelier
PROJECTOR LENSES. See Lenses.

PULLERS, Armature Shaft

Motor Pulley, Shaft & Pinion Pullers & Extractors.
Allen Electric & Equipment Co., Kalamazoo, Mich.
Big Buster. See Premier Elec. Co.
Crane Puller Co., Waltham, Mass.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Company, Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts. Philadelphia, Pa.
Little Giant. See Premier Elec. Co.
Peerless. See Electric Service Supplies Co.
Premier Electric Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill

PULLEYS, Composition

General Electric Co., Schenectady, N. Y.
Rockwood Mfg. Co., Indianapolis, Ind.
Sprucolite Co., Bloomfield, N. J.

PUMPS, Oil Burner

Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago
Reflex. See Simplex Oil Heating Co.
Simplex Oil Heating Co., 1199 Eddy, Providence, R. I.
Teesdale Mfg. Co., 427 Market, Grand Rapids, Mich.
Zisch Engineering Co., 39 Ave. L, Newark, N. J.

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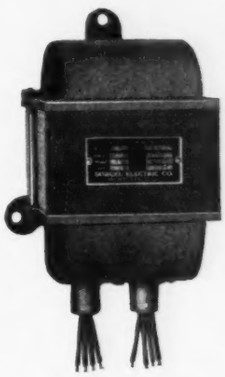

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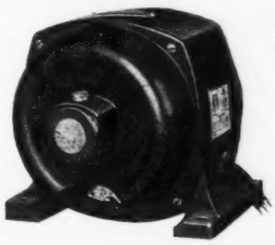

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Dunham Co., C. A., 450 East Ohio, Chicago, Ill.
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hubbard's Sons, Norman, 1 Carlton Ave., Brooklyn, N. Y.
Leiman Bros., 23 Walker, New York, N. Y.
Packard. See Hubbard's Sons, Norman.
PUNCHING PRESSES. See Presses, Punching.

PUNCHING and BENDING, Sheet Steel

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

RACKS, Wire Reel

(With Tension Device Attached).
Armature Coil Equipment Co., 3415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Elec'l Wks., P. E., 1829 Chouteau Ave., St. Louis, Mo. (Tensionless Dereeler)
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Elec. Co., Schenectady, N. Y. (Tension Indicator.)
Mutual Foundry & Machine Co., Atlanta, Georgia.
Segur. See Electric Service Supplies Co.

RADIO CIRCUIT COMPONENTS

This heading includes Inductances (Coils), Capacitors (Condensers), Fixed Resistances, Grid Leaks, Transformers, Choke Coils, and Filters, also Amplifier Units and Kits.
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Acme Products Co., 23 Elkins (S. B.), Boston, Mass.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Air-King Products Co., 222 Grand, New York, N. Y. (Kit.)
Ajax Elec. Specialty Co., St. Louis, Mo.
Alden Mfg. Co., Springfield, Mass.
All-American Mohawk Corp., 4201 Belmont Ave., Chicago.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Amerchoke. See American Transformer Co.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
American Transformer Co., Newark, N. J
Amperite Rheostat. See Radiall Co.
Areo Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arctic. See Premier Elec. Co.
Audioformer Transformer. See Pacent Electric Co.
Audiohm. See Electrad, Inc.
Autoformer. See Thordarson Elec. Mfg. Co.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn.
B-Conomizer. See Pilot Elec. Mfg. Co.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bonine. See Turn-it Radio Sales.
Branston Co., Chas. A., 297 Washington, Buffalo, N. Y.
Bremer-Tully Mfg. Co., 520 S. Canal, Chicago, Ill.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
Browning-Drake Corp., 110 Brookline, Cambridge, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Elec. Mfg. Co.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Central Radio Corp., Beloit, Wis.
Centraline. See Pilot Elec. Mfg. Co.
Certified Condenser. See Radio Condenser Co.
Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Cole Radio Mfg. Corp., 536 Bloomfield Ave., Bloomfield, N. J.
Columbia Metal Products Co., 360 E. Grand Ave., Chicago.
Concertone. See Chicago-Jefferson Fuse.
Connectoralds. See Alden Mfg. Co.
Continental Carbon, Inc., Cleveland, O.
Continental. See Gardiner & Hepburn, Inc.
Counterphase Kit. See Bremer-Tully Mfg. Co.
Cresradio Corp., 166-32 Jamaica Ave., Jamaica, N. Y.
Crefot. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
DeForest Radio Co., Jersey City, N. J.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 4377 Bronx Blvd., New York.
Duratran. See Dubilier Condenser Corp.
Durham & Co., 1936 Market, Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York.
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc. (Div. of P. R. Mallory & Co.), Portchester, N. Y
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
Equitrol. See Cardwell Mfg. Corp.
Euphonic. See Bremer-Tully Mfg. Co.
Excelsior Radio Corp., 216 Wallabout, Brooklyn, N. Y.
E-Z. See Polymet Mfg. Corp.
Faradon. See Wireless Specialty Apparatus Co.
Fast Co., John E., Crawford & Barry Ave., Chicago, Ill.
Ferranti, Inc., 130 W. 42nd, New York, N. Y.
Filiatrol. See De Jur-Amsco Corp.
Filtrola. See All-American Mohawk Corp.
Flechtheim Co., A. M., 136 Liberty, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind.
F. & H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa.
General Instrument Corp., 477 Broadway, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
General Transformer Corp., 900 W. Jackson Blvd., Chicago.
General Winding Co., 214 Fulton, New York, N. Y.
Gen-Win. See General Winding Co.
Glastor. See Daven Corp.
Globar Corp., Niagara Falls, N. Y.
Glo-Dial. See Wireless Radio Corp.
Gray & Danielson Mfg. Co., 260 1st, San Francisco, Cal.
Halldorson Co., 4745 N. Western Ave., Chicago, Ill.
Hammarlund Mfg. Co., 424 W. 33rd, New York, N. Y.
Hammarlund-Roberts, 1182 Broadway, New York. (Kit.)
Hardwick Field, Inc., 215 Emmet, Newark, N. J.
Harmonik. See Karas Elec. Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. (TRF Kits.)
Heath & Co., Geo. W., 260 First Ave., Newark, N. J.
Hedgehog Transformer. See Premier Elec. Co.

Heinemann Elec. Co., Philadelphia, Pa.
Hi-Q Kit. See Hammarlund.
Hy-Wat. See Electro Motive Engineering Corp.
Igrad Condenser & Mfg. Co., 26 Avenue D, Rochester, N. Y.
Infra-Dyne. See Gray & Danielson Co.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Isograd, Isolesk. See Pilot Elec. Mfg. Co.
Karas Elec. Co., 4040 N. Rockwell, Chicago, Ill.
Keiford. See American Specialty Co.
Kilograd. See Pilot Elec. Mfg. Co.
Kroblack. See Mountford, C. E.
Kuprox. See Kodel Radio Corp.
Langbein-Kaufman Radio Co., 62 Franklin, New Haven, Conn.
Lavite. See Aerovox Wireles Corp.
Lautz Mfg. Co., 245 N. J. R. R. Ave., Newark, N. J. (Radio Resistance).
Lekeless. See Benjamin Elec. Mfg. Co.
Lemnis. See General Winding Co.
L. M. C. See Lautz Mfg. Co.
Loftin-White. See Hammarlund Mfg. Co.
Loless. See Wireless Radio Corp.
Lynch, Arthur H., 1775 Broadway, New York, N. Y.
Marco. See Martin-Copeland Co.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Maxitran. See Electrical Research Laboratories.
Mayolian Corp., 1668 Webster Ave., New York, N. Y. (Tone Filter.)
Meggit. See Cole Mfg. Corp.
Melco-Supreme. See De Jur-Amsco Corp.
Melcoupler. See Robertson-Davis Co.
Meloformer. See Robertson-Davis Co.
Metaleak. See Dubilier Condenser Corp.
Metraligh. See General Instrument Corp.
Micadon Condenser. See Dubilier Condenser Corp.
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y. (Amplifier Kit.)
Mica-Static. See Dubilier Condenser Corp.
Micon Condenser. See Dubilier Condenser Corp.
Microcondenser. See Sterling Mfg. Co.
Microgrid. See Pilot Elec. Mfg. Co.
Micrometric. See Karas Elec. Co.
Microstat. See Premier Elec. Co.
Midline. See Hammarlund Mfg. Co.
Modern Electric Mfg. Co., Toledo, O.
Mountford, C. E., 30 Sullivan, New York, N. Y.
Muter Co., Leslie F., 76th St. and Greenwood Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass.
Neutro-Grad. See Pilot Elec. Mfg. Co.
New York Coil Co., Mount Clare, Pa.
Nutmeg. See Hart & Hegeman Mfg. Co.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, O.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill. (Resistance.)
Orthometric. See Karas Elec. Co.
Orthophone. See De Jur-Amsco Corp.
Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
Panatrol. See Wireless Radio Corp.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Perry Wire Works, 250 New Main St., Yonkers, N. Y.
Phasatrol. See Electrad, Inc.
Philmore Mfg. Co., 106 7th Ave., New York, N. Y.
Plander. See De Jur-Amsco Corp.
Pierce Airo. See United Scientific Laboratories.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Pilotran. See Pilot Elec. Mfg. Co.
Potter Mfg. Co., North Chicago, Ill.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Power Box. See Scott Sales Co.
Powerohm. See International Resistance Co.
Powrad, Inc., 486 Johnson Ave., Brooklyn, N. Y.
Precise Mfg. Corp., 254 Mill, Rochester, N. Y.
Premier Elec Co., Dept. 1323, 3800 Ravenswood Ave., Chicago, Ill.
Protectoraid. See Alden Mfg. Co.
Pyrobar. See Aerovox Wireless Corp.
Radiall Co., 50 Franklin, New York, N. Y.
Radio Appliance Corp., Springfield, Mass.
Radio Condenser Co., Thorn & Copewood, Camden, N. J.
Radio Engrg. Laboratories, 100 Wilbur Ave., Long Island City, N. Y. (Short Wave Kit.)
Radioloc Switch. See Cutler-Hammer Mfg. Co.
Radio Receptor Co., 106 7th Ave., New York.
Radiostat. See Allen-Bradley Co.
Raola. See Modern Elec. Mfg. Co.
Rauland-Lyric. See All American Mohawk Corp.
Receptrad. See Radio Receptor Co.
Reesonator. See F. & H. Radio Laboratories.
Regal. See American Specialty Mfg. Co.
Reliable Parts Mfg. Co., Wellington, O.
Remler. See Gray & Danielson Co.
Resistaformer. See Aerovox Wireless Corp.
Resistograd. See Pilot Elec. Mfg. Co.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent), **Hatheway & Co., 16 Hudson, New York, N. Y.**
Roberts Condenser. See Hammarlund Mfg. Co.
Robertson-Davis Co., 412 Orleans, Chicago, Ill.
Samson Elec. Co., Canton, Mass. (TRF Kits.)
Sangamo Elec. Companies, Springfield, Ill.
Scanlan Elec. Mfg. Co., 1113 N. Franklin, Chicago, Ill. (Output Transformers.)
Scovill Mfg. Co., Waterbury, Conn.
Senior. See All American Mohawk Corp.
Sensory. See Heinemann Electric Co.
Sevison Magneto Engr. Co., 397 Phillips, Toledo, O.
Sickles Co., F. W., 130 Union, Springfield, Mass.
Signal Elec. Mfg. Co., Menominee, Mich.
Silver-Marshall, Inc., 846 W. Jackson Blvd., Chicago. (Amplifier Kits.)
Silvertone. See Radio Receptor Co.
S. L. S. See Wireless Radio Corp.
S. L. T. See General Instrument Corp.
Somersolo. See DeForest Radio Co.
Sonatron Tube Co., Chicago, Ill. (Resistance Coupled Amplifier).
Splitmeter. See Premier Electric Co.
Sprague Specialties Co., Dept. M., Quincy, Mass.
Standard Transformer Co., Warren, O.
Sta-Put. See Martin-Copeland Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, O.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Super Multiformer. See Precise Mfg. Corp.
Supertran Transformer. See Ford Radio & Mica Co.
Symphony. See Modern Elec. Mfg. Co.
Syncrodenser. See Precise Mfg. Corp.
Tandem. See Bremer-Tully Mfg. Co.
Telemonic Coil. See Condenser Corp. of America.
Telos Coil. See Condenser Corp. of America.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago.
Thorola. See Reichman Co.
Tobe Deutschman Co., Canton, Mass.
Tone Control. See Sprague Specialties Co.
Toroid. See All American Mohawk Corp.
Torostyle. See Bremer-Tully Mfg. Co.
Transcript-Clapp Kit. See Samson Electric Co.

Truphonic Amplification. See Alden Mfg. Co.
Twin-aud. See Peerless Radio Co.
Twin-Eight Transformers. See Bodine Electric Co.
Two-Ten & Two-Eleven. See Silver-Marshall.
Tyrman Elec. Corp. 143 W. Austin Ave., Chicago, Ill.
Ultra Vario. See Bruno Radio Corp.
Universler Condenser. See Auburn Button Works.
Universal Electro Chemical Corp., 30 W. 15th, New York.
Universal Winding Co., Boston, Mass.
Variall Condenser. See Muter Co.
Volta. See Universal Electro Chemical Corp.
Waterbury Button Co., Waterbury, Conn.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn, N. Y.
Wireless Specialty Apparatus Co. (J. P.), Boston, Mass.
RADIO HARDWARE. See Radio Mountings.

RADIO MOUNTINGS

Coil Mountings, Coil Sliders and Rods, Switches, Detectors, Detector and Grid Leak Mountings, Panel Brackets, Special Radio Hardware & Trimmings, Metal Dials, Metal Panels, etc.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Alden Mfg. Co., Brockton, Mass.
American Radio Hardware Co., 135 Grand, New York.
Bonza. See Haydon & Haydon.
Carborundum Co., Niagara Falls, N. Y. (Detector.)
Chapman Machine Co., Terryville, Conn.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Durham & Co., 1936 Market, Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y. (Metal Panels.)
Eureka. See Morse Co., Frank W.
General Etching & Mfg. Co., 3072 West Grand Ave., Chicago, Ill. (Metal Panels & Escutcheons.)
Glodial. See Wireless Radio Corp.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Haydon & Haydon, 167 Chambers, New York, N. Y.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th and Greenwood Ave., Chicago.
Na-Ald. See Alden Mfg. Co.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Union Insulating Co., 296 Broadway, New York, N. Y.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.
RADIO PANEL ENGRAVING. See Engraving, Radio Panel

RADIO RECEIVER PARTS

Rheostats, Sockets, Plugs, Jacks.
Acme Elec. & Mfg. Co., 1652 Rockwell, Cleveland, Ohio.
Alden Mfg. Co., Springfield, Mass.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Automotive Equipment Co., 317 Halsey, Newark, N. J.
B. M. S. See Brooklyn Metal Stamping Corp.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. (Multiple Plugs.)
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Brach Mfg. Corp., L. S., 120 Sussex Ave., Newark, N. J.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn.
Cabelug. See Jones, Howard B.
Carter Radio Co., 3300 S. Racine Ave., Chicago, Ill. (Also Socket Adapters.)
Central Radio Laboratories, 14 Keefe Ave., Milwaukee.
Centralab. See Central Radio Laboratories.
Clarostat Mfg. Co., 285 N. Sixth, Brooklyn, N. Y.
Cle-Ra-Tone. See Benjamin Elec. Mfg. Co.
D. A. Radio Co., 30 Hollister, Buffalo, N. Y.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
De Veau. See Stanley & Patterson.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Duostat. See De Jur-Amsco Corp.
E-Z. See Polymet Mfg. Corp.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I.
Fantail Plug. See Brooklyn Metal Stamping Corp.
Frost, Herbert H., 1142 W. Beardsley, Elkhart, Ind.
Gem-Jac. See Frost, Herbert H.
General Instrument Corp., 477 Broadway, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
Gray & Danielson Mfg. Co., 260 First, San Francisco, Cal.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Heinemann Elec. Co., Philadelphia, Pa.
Imp. See Carter Radio Co.
Jones, Howard B., 2226 Wabansia, Chicago, (Multiple Plug.)
Kissner Radio Corp., 1032 E. 178th, New York, N. Y.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Modu-Plug. See Central Radio Lab.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th & Greenwood Ave., Chicago.
Pacent Elec. Co., 91 Seventh Ave., New York, N. Y.
Pan-Tab Jack. See Frost, Herbert H.
Philmore Mfg. Co., 106 Seventh Ave., New York, N. Y.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Premier Elec. Co., Dept. 1323, 3800 Ravenswood Ave., Chicago, Ill.
Recto Mfg. Co., 23 W. Third, Cincinnati, Ohio.
Royalty. See Electrad, Inc.
Samson Elec. Co., Canton, Mass.
Socostat. See D. A. Radio Co.
Stanley & Patterson, 150 Varick, New York, N. Y.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio
Tubestat. See Muter Co.
Union Radio Corp., 124 Sussex Ave., Newark, N. J.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO RECTIFIER TUBES

Armstrong Elec. & Mfg. Co., 351 Halsey, Newark, N. J.
Cable Supply Co., 31 Union Square, New York, N. Y.
Ceco Mfg. Co., 702 Eddy, Providence, R. I.
Conneway Elec. Laboratories, 406 Jefferson, Hoboken, N. J.
Cunningham, Inc., E. T., 370 Seventh Ave., New York, N. Y.
DeForest Radio Co., Franklin St. & Central Ave., Jersey City, N. J.
Diamond Vacuum Products Co., 4053 Diversey Ave., Chicago.
Gold Seal Electrical Co., 250 Park Ave., New York, N. Y.
Manhattan Elect. Supply Co., 17 Park Pl., New York, N. Y.
Northern Mfg. Co., 367 Ogden, Newark, N. J.
Perryman Electric Co., 33 W. 60th, New York, N. Y.
Radio Corp. of America, 233 Broadway, New York.
Raytheon Mfg. Co., Kendall Square Bldg., Cambridge, Mass.
Sonatron Tube Co., 108 W. Lake, Chicago, Ill.
Specialty Appliance Co., 6611 Euclid Ave., Cleveland, Ohio.
Sylvania Products Co., Emporium, Pa.
Televocal Corp., 588 Twelfth, West New York, N. J.
United Radio & Elec. Corp., 500 Chancellor Ave., Irvington, N. J.
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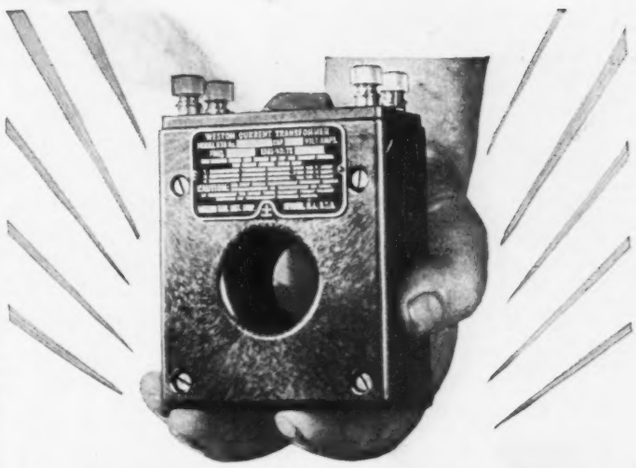

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Birnbach Radio Co., 254 W. 31st St., New York, N. Y.
Blue Ribbon. See Crescent Braid Co.
Brach Mfg. Co., L. S., Newark, N. J.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Adapters.)
Connectoralds. See Alden Mfg. Co.
Cornish Wire Co., 30 Church, New York, N. Y.
Corwico. See Cornish Wire Co.
Crescent Braid Co., Providence, R. I.
Crescent Insulated Wire & Cable Co., Trenton, N. J.
De Luxe, 50 W. Houston, New York, N. Y.
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Echo. See Cornish Wire Co.
Enterprise Mfg. Co., Third & Dauphin Sts., Philadelphia, Pa. (Adapters).
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind. (Adapters.)
Lusterized. See American Braiding Co.
Manhattan Insulated Wire Co., 17 W. 60th St., New York.
Morse Co., Frank W., Boston, Mass.
Power, Inc., Harold J., Medford Hillside, Mass. (Adapters).
Radio Receptor Co., 106 Seventh Ave., New York, N. Y. (Adapters.)
Riga. See Birnbach Radio Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio. (Adapters).
Wilkens Mfg. Co., 52 Orwaupun St., White Plains, N. Y.

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United States Radium Corp., 535 Pearl, New York, N. Y.
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RAWHIDE GEARS. See Gears & Pinions, Rawhide.
READING LAMP BASES. See Bases, Reading Lamp.
REAMERS, Pipe. See Stocks, Dies and Reamers.
RECEPTACLES, Lamp. See Sockets and Receptacles.

RECEPTACLES, Plug, Heavy Duty

	KEY
Battery Charging	See B
Floor Boxes	See F
Welding	See W
Machine Tool	See W
Watertight, Marine, Mine	See M
Car Trailer Connection	See C
Extension	See E

A. B. C. See Anderson Mfg. Co.
Adam Electric Co., Frank, St. Louis, Mo. F
Adapti Co., 2996 E. 72nd, Cleveland, O.. F
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass. B W M C E
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Arnessen Electric Co., 13 Water, New York M
Arrow Elec. Co., Hartford, Conn. F B W
Auth Electrical Specialty Co., 422 E. 53rd, New York, N. Y. E
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill. F W M
Bryant Elec. Co., Bridgeport, Conn. (Also Range Type.) W
Campbell. See Steel City Elec. Co.
Cannon Elec. Development Co., 420 West Ave., 33, Los Angeles, Cal. F
C. E. M. Co. See Conn. Elec. Mfg. Co.
C. H. See Cutler-Hammer Mfg. Co.
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Crouse-Hinds Co., Syracuse N. Y. B W
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Fullman. See Steel City Elec. Co.
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Hart & Hegeman Mfg. Co., Hartford, Conn. B W
Hessel Co., W. F., 76 Greenwich, New York, N. Y. W M E
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Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. F B W M
Latrobe. See Fullman Mfg. Co.
Loeffelholz & Co., Milwaukee, Wis. C
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Preset. See Walker Bros. Co.
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Square D. Co., Detroit, Mich. W
Stanley & Patterson, 150 Varick, New York, N. Y. F
Steel City Elec. Co., Pittsburgh, Pa.. F E
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V. V. Fittings Co., 711 Cherry, Philadelphia, Pa. M
Walker Bros., 1417 Sansom, Philadelphia F E
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. F B W M
Yale. See Electric Products Co.

RECORDERS, Elapsed Time. See Indicators, Operation.
REDUCERS, Socket. See Socket Reducers.
REFLECTOR LENSES. See Lenses.

REFLECTORS, Porcelain Enameled, Steel

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Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Cello, Inc., 96 Prince, New York, N. Y.
Dunlap Co., John, Carnegie, Pa.
Durex. See Wheeler Reflector Co.
Federal Electric Co., 8700 S. State, Chicago, Ill.
Goodlites. See Goodrich Elec. Co.
Goodrich Elec. Co., 1650 Ogden Ave., Chicago, Ill.
Isolux. See Wheeler Reflector Co.
Ivanhoe Division of Miller Co., Cleveland.
Marbelite Art Products Co., 140 N. Robey, Chicago, Ill.
Maxolite. See Raleo Mfg. Co.
Monk, H. E., 18 Warren, New York, N. Y.
Multi Elecl. Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Overbaugh & Ayers, 411 S. Clinton, Chicago, Ill.
Para Steel. See Wheeler Reflector Co.
Perfection. See Tindall & White.
Philadelphia Elec'l & Mfg. Co., 1228 N. 31st, Philadelphia.
Quad. See Quadrangle Mfg. Co.
Quadrangle Mfg. Co., 30 S. Peoria, Chicago Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Sturdox. See Benjamin Elec. Mfg. Co.
Tindall & White, 33 W. 60th, New York, N. Y.
Vaporlux. See Wheeler Reflector Co.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Wheeler Reflector Co., 275 Congress, Boston, Mass.

REFRIGERANTS. See Chemicals, Refrigeration.
REFRIGERATION CHEMICALS. See Chemicals, Refrigeration.

REFRIGERATOR CABINETS

Airtite. See Rhinelander Refrigerator Co.
Alaska Refrigerator Co., Muskegon, Mich.
Allen Filter Co., 25 S. St. Clair, Toledo, O. (Water Cooler Unit.)
American Refrigerator Corp., Peru, Ind.
Argus Products Co., 174 E. Water, Portland, Ore.
Arlington Refrigerator Co., Arlington, Vt.
Athermos. See Gurney Refrigerator Co.
Automatic. See Illinois Refrigerator Co.
Baldwin Refrigerator Co., Burlington, Vt.
Banta Refrigerator Co., Clearfield, Pa.
Belding-Hall ElectrICE Corp., Belding, Mich.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bohn Refrigerator Co., St. Paul, Minn.
Boyer Refrigerator Co., 2217 Locust, St. Louis, Mo.
Castle Double-Servis. See Home Products Corp.
Cavalier. See Tennessee Furniture Co.
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Champion Refrigerator Co., 131 E. 34th, New York, N. Y.
Cold Storage Refrigerator Co., Eau Claire, Wis.
Crystal Refrigerator Co., Fremont, Neb.
Crysteel. See Benjamin Elec. Mfg. Co.
Dillingham Mfg. Co., Sheboygan, Wis.
Dry-Cold. See Hill & Co.
Economic. See Leonard Refrigerator Co.
Eddy & Sons Co., D., 336 Adams, Boston, Mass.
Erie Art Metal Co. & Erie Metal Furniture Co., Erie, Pa.
General Necessities Corp., General Necessities Bldg., Detroit, Mich.
Gibson Refrigerator Co., Greenville, Mich.
Gloekler Co., Bernard, 1627 Penn Ave., Pittsburgh, Pa.
Gruendler Mfg. Co., Gustav J., 814 N. Broadway, St. Louis.
Gurney Refrigerator Co., Fond du Lac, Wis.
Harder Refrigerator Corp., Cobleskill, N. Y.
Haskelite Mfg. Co., 120 S. La Salle, Chicago, Ill. (Knockdown.)
Heintz Mfg. Co., Front & Olney Aves., Philadelphia, Pa.
Heinz & Munschauer, Superior and Randall, Buffalo, N. Y.
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Hibbard Co., Euclid Ave. at 65th, Cleveland, O.
Hill & Co., C. V., 360 Pennington Ave., Trenton, N. J.
Holderle Bros., Inc., 339 Exchange, Rochester, N. Y.
Home Products Corp., Jackson, Mich.
Howe Scale Co., Rutland, Vt.
Iceless Cooler Corp., 225 N. Michigan Ave., Chicago, Ill. (Ice Cream Cabinets.)
Illinois Refrigerator Co., Morrison, Ill.
Jewett Refrigerator Co., Buffalo, N. Y.
Kingston. See Lorillard Refrigerator Co.
Kleen Kold. See Harder Refrigerator Corp.
Knox Products Co., Fourth & Greenhill Ave., Wilmington, Del.
Knox. See Erie Art Metal Co.
Leonard Refrigerator Co., Div. of Electric Refrigeration Corp., Grand Rapids, Mich.
Ligonier Refrigerator Co., Ligonier, Ind.
Liver & Co., C. B., Omaha, Neb.
Loeber Co., Henry G., 151 E. 126th, New York, N. Y. (Ice Cream Cabinet.)
Lorillard Refrigerator Co., 44 Cooper Square, New York.
Louisville Refrigerator Corp., 4460 Louisville Ave., Louisville, Ky.
Louisville Tin & Stove Co., Louisville, Ky.
Mace & Co., L. H., 55 E. 150th, New York, N. Y.
Maine Mfg. Co., Nashua, N. H.
McCray Refrigerator Sales Corp., 2864 Lake St., Kendallville, Ind.
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Omaha Fixture & Supply Co., 11th and Douglas, Omaha
Oreole. See Ottenheimer Bros.
Ottenheimer Bros., Baltimore, Md.
Plymetl. See Haskelite Mfg. Co.
Ranney Refrigerator Co., Greenville, Mich.
Reol. See Ottenheimer Bros.
Reolite. See Ottenheimer Bros.
Revolvo. See Iceless Cooler Corp.
Rex Mfg. Co., Connersville, Ind.
Rexdale. See Rex Mfg. Co.
Rhinelander Refrigerator Co., Rhinelander, Wis.
Saco-Lowell Shops, Newton Upper Falls, Mass.
Sanitary Refrigerator Co., Fond du Lac, Wis.
Schmidt Co., C., John and Livingston, Cincinnati, O
Seeger Refrigerator Co., St. Paul, Minn.
Sherer-Gillett Co., 601 W. Washington, Chicago, Ill.
Steeprest. See Heintz Mfg. Co.
Success Mfg. Co., Gloucester, Mass.
Tennessee Furniture Co., Chattanooga, Tenn.
Vogt. See General Necessities Corp.
Ward Refrigerator Co., 6901 S. Alameda, Los Angeles, Cal
White Mountain. See Maine Mfg. Co.
White Seal. See Louisville Refrigerator Co.

REFRIGERATOR CONDENSER UNITS. See Condenser Units, Refrigerator.

REFRIGERATOR FITTINGS

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RELAYS

(See also Circuit Breakers and Thermostats.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Signal Engineering & Mfg. Co., 146 W. 14th, New York
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Wilcolator Co., 17 Nevada, Newark, N. J.

REMOTE CONTROL SWITCHES. See Switches, Remote Control.

REMOVERS, Coil

Ewing Mfg. Company, Middleport, Ohio.

RESISTANCE

Boxes. See Instruments, Laboratory Standard
Coil Cores. See Cores, Resistance.
Test Sets. See Instruments.
Units, Radio. See Radio Circuit Components.
Units. See Units, Rods & Grids.
Wire. See Wire Bare.

RESISTORS

Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ward-Leonard Electric Co., Mount Vernon, N. Y.

RESISTORS. See Units, Rods & Grids.
REVOLUTION COUNTERS. See Tachometers.
RHEOSTATS,
Motor-Controlling. See Controllers, also Rheostats.
Radio. See Radio Receiver Parts.
Sewing Machine. See Controllers.

RHEOSTATS

	KEY
Battery Charging	See B
Stage Dimming	See D
Meter Testing (Laboratory)	See L
Plating Tank	See P
Motion Pictures (Projector Lamp)	See M
Motor Starting, Field and Speed Regulating	See F

	F	B	D	P	M	L
Allen-Bradley Co., 493 Clinton, Milwaukee						L
Biddle, James G., 1211 Arch, Philadelphia						L
Boice, W. B. & J. E., 1730 Norwood Ave., Toledo, O.						L
Brach Mfg. Corp., L. S., Newark, N. J. (Radio Battery Control.)		B				
Bradleystat. See Allen-Bradley Co.						
Controlite. See Ward Leonard Elec. Co.						
Crown Rheostat & Supply Co., 1910 Park Ave., West Chicago, Ill.				P		
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis.	F	B	D			L
Economic Rheostat Switch Co., 3551 N. 5th, Philadelphia, Pa.	F					
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.	F					
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O.		B				
General Electric Co., Schenectady, N. Y.	F					L
Hanson-Van Winkle-Munning Co., Matawan, N. J.				P		
Holzmuller, C. J., 1108 Howard, San Francisco, Cal.			D			
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y.			D		M	
Knoeller Elec. Co., De Pere, Wis.	F					
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago	F	B	D		M	L
Optimus. See Hanson-Van Winkle-Munning Co.						
Robertson, Leo F., 536 W. 22nd, New York, N. Y.					M	
Schaefer Bros. Co., 1059 W. 11th, Chicago		B				
Simplicity. See Cutler-Hammer Mfg. Co.						
Union Elec. Mfg. Co., Milwaukee, Wis.	F					
Universal. See Ward Leonard Elec. Co.						
Vitrohm. See Ward Leonard Elec. Co.						
Ward Leonard Elec. Co., Mt. Vernon, N. Y.	F		D		M	
Watton. See Electric Products Co.						
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.	F				M	

RINGS Seal. See Packing.

RIVETS

Chase Brass & Copper Co., Waterbury, Conn.
Chicago Rivet & Specialty Co., 1830 S. 54th, Chicago, Ill.
Hassall, Inc., John, 402 Oakland, Brooklyn, N. Y.
Hungerford Brass & Copper Co., Div. of The Chase Brass Companies, Inc., 88 Lafayette, New York, N. Y.
Manufacturers Belt Hook Co., 1315 W. Congress, Chicago, Ill.
Merwin Mfg. Co., Bridgeport, Conn. (Solid & Tubular).
Nelson Rivet Co., Taunton, Mass.
Stimpson Co., Edwin B., 70 Franklin Ave., Brooklyn, N. Y.
Thomson Mfg. Co., Judson L., Waltham, Mass.
Tubular Rivet & Stud Co., 87 Lincoln, Boston, Mass.
Wright & Corson Mfg. Co., Bridgeport, Conn.

RODS, Resistance. See Units, Rods and Grids.
ROLLER BEARINGS. See Bearings, Ball and Roller.

ROLLS, Coil Flattening

Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

RUBBER BELTS. See Belts, Rubber.

RUBBER, Hard

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American Hard Rubber Co., 11 Mercer, New York, N. Y.
Connecticut Hard Rubber Co., West Haven, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Luzerne Rubber Co., Murhead, near Dewey Trenton, N. J.
Mahoganite. See American Hard Rubber Co.
New York Hard Rubber Turning Co., 212 Centre, New York.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Radiolite. See Superior Hard Rubber Co.
Stokes Rubber Co., Trenton, N. J.
Superior Hard Rubber Co., Butler, N. J.
U. S. Rubber Co., 1790 Broadway, New York, N. Y.
Vulcanized Rubber Co., 251 4th Ave. New York, N. Y.
Vulco Panels. See Vulcanized Rubber Co.

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Republic Rubber Co., Youngstown, O.

RUBBER, SEMI-HARD. See Rubber Mechanical Goods.

RUBBER, Sponge

Foyeraft Rubber Co., Ashland, O.

RUBBER TAPE. See Tape, Rubber and Friction.
RUBBER TUBING. See Tubing, Rubber.
RUST PROOFING. See Plating & Finishing.
SAL AMMONIAC. See Chemicals, Battery.
SALTS, Battery. See Chemicals, Battery.
SATURATING TANKS. See Wire Manufacturing Machines
SCREW SHELLS, Socket. See Shells, Screw Socket.

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Vim Tool Co., 149 Broadway, New York, N. Y.

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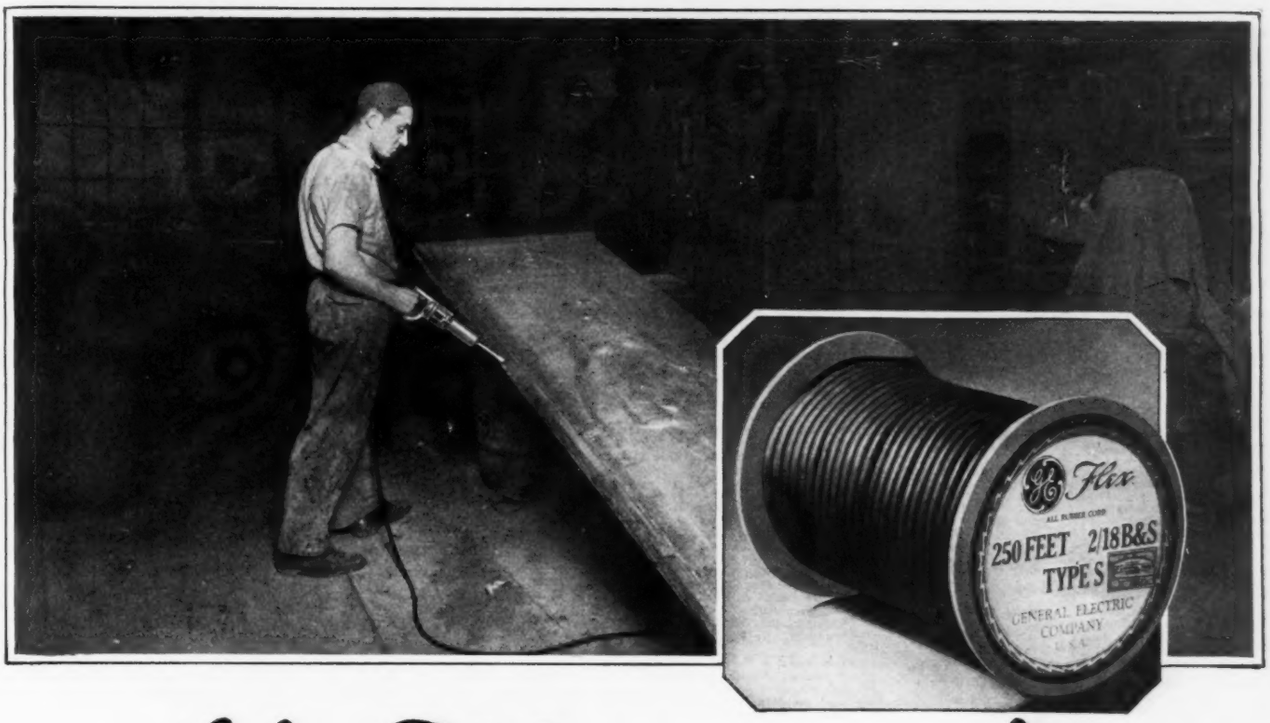

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Cotoron Co., Bridgeport, Pa.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Colonial-Premier Co., 225 W. Ohio, Chicago, Ill.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Hubbell, Inc., Harvey, Bridgeport, Conn.
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Linden & Co., 891 Broad, Providence, R. I.
Meisel Press Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Olsen Mfg. Co., 56 Commercial, Worcester, Mass.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
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Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Steiner & Co., 297 Washington, Newark, N. J.
Thomaston Mfg. Co., Thomaston, Conn.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Wilmington Fibre Specialty Co., Wilmington, Del.

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Hartford Machine Screw Co., Hartford, Conn.

SCREWS, Drive

Parker-Kalon Corp., 190 Varick, New York, N. Y.

SCREWS, Machine

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Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Hubbell, Inc., Harvey, Bridgeport, Conn.
New England Screw Co., Dept. A, 44 Farnsworth, Boston,
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
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American Screw Co., Providence, R. I.

SECOHMMETERS. See Instruments, Laboratory Standard.
SEGMENTS. See Discs, Armature.

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Campbell Elec. Co., Kansas City, Mo.
Carlile & Doughty, 2530 N. Broad, Philadelphia, Pa.
Chattanooga Battery Box Co., Chattanooga, Tenn.
Certified. See Ermet Products Co.
Consumers Rubber Co., 1302 Ontario, Cleveland, O.
Ermet Products Co., Sherman Drive & 16th, Indianapolis, Ind. (Wood.)
Estes & Sons, E. B., 25 Vanderbilt Ave., New York. (Wood.)
Indianapolis Box & Separator Co., 1450 E. 19th St., Indianapolis, Ind. (Wood.)
Indianapolis Mfg. Co., Indianapolis, Ind.
Insco. See Indianapolis Box & Separator Co.
Link & Hemrick, Inc., 555 W. 52nd, New York, N. Y.
Red Band. See Indianapolis Mfg. Co.
Stewart Mfg. Co., Wm. E., 14th & Elm, Flint, Mich. (Wood.)
Wick Lumber Co., R., 539 W. 52nd, New York. (Wood.)

SHADES

Aluminum. See Shades, Metallic.
Asbestos. See Shades, Fabric.
Bamboo. See Shades, Fabric.
Brass. See Shades, Metallic.
Cast Metal. See Shades and Domes.
Copper. See Shades Metallic.
Cretonne. See Shades, Fabric.
Leaded. See Shades and Domes.
Leather. See Shades. Fabric.
Linen. See Shades, Fabric.
Mica. See Shades, Mica.
Mosaic. See Shades and Domes.
Paper. See Shades, Fabric.
Parchment. See Shades, Fabric.
Silk. See Shades, Fabric.
Stamped Metal. See Shades, Metallic; also Shades and Domes.
Steel. See Shades, Metallic.
Tin. See Shades, Metallic.
Zinc. See Shades, Metallic.

SHADES, Fabric

Asbestos Cretonne, Leather, Linen, Paper, Silk, Bamboo, Parchment.
Acme Lamp Shade Co., 630 W. Madison, Chicago. (Silk.)
Adelphi Lamp Shade Co., 242 Fifth Ave., New York. (Silk.)
Admiration Lamp Shade Co., 160 Madison Ave., New York, N. Y. (Silk.)
Andrews Co., C. M., 32 E. 30th, New York, N. Y. (Silk.)
Art Lamp Shade Studios, 316 Fifth Ave., New York, N. Y.
Audrey Art Shade Studios, 105 Thatford Ave., Brooklyn.
Block & Co., L. D., 57 E. 18th St., New York, N. Y.
Borghese. See Hall, Chas.
Daiger Co., Charles V., 76 Essex, Boston, Mass. (Silk.)

Eastern Art Shop, 14 W. 19th, New York. (Parchment.)
Foss Parchment Shade Studio, 1338 E. 12th, Oakland, Cal. (Parchment.)
Foslite. See Foss Parchment Shade Studio.
Frostelene. See Art Lamp Shade Studios.
Gibson Art Co., 223 W. Fourth, Cincinnati, Ohio. (Paper.)
Hall, Chas., 3 E. 40th, New York, N. Y. (Paper Parchment.)
Hanson Co., Paul, 15 E. 26th, New York, N. Y. (Chintz.)
Harris Mfg. Co., 122 University Place, New York, N. Y. (Parchment.)
Herco Art Mfg. Co., Meriden, Conn.
Hoft Studio, 46 W. 21st, New York, N. Y. (Parchment.)
Idealite Elec. Lamp Shade Mfg. Co., 7 E. 17th, New York, N. Y. (Parchment.)
Kapa Shell. See Wardwell, E. H.
Kenton Mfg. Co., Worcester, Mass. (Silk.)
Kerwin. See Hall, Chas.
Kno-Glair. See Hamilton, M. E.
Lamb Bros. & Greene Corp., Napannee, Ind. (Silk.)
Luxrite. See John H. St. John.
Maxwell-Ray Co., Milwaukee, Wis. (Silk.)
Monarch Lamp & Shade Co., 210 N. Second, Philadelphia, Pa. (Silk.)
Morimura Bros., 58 W. 23rd, New York. (Bamboo, Silk, Cretonne.)
Parchment Novelty Co., 87 E. 10th, New York, N. Y. (Parchment.)
Patent Lamp Shade Co., 1361 Franklin Ave., Philadelphia.
Peerless Lamp Shade Mfg. Co., 114 E. 25th, N. Y. (Silk.)
R. D Electric Co., Fort Wayne, Ind. (Linen and Silk.)
Reuter, Wm., 32 W. 34th, New York, N. Y. (Silk.)
Rindsberger Mfg. Corp., 22 E. 24th, Chicago, Ill.
Rosita Studio, 10 W. 28th, New York, N. Y. (Parchment and Leatherette.)
Sanderson's Art Co., Milwaukee, Wis. (Parchment.)
Springel & Son, A., 26 S. 3rd, Philadelphia, Pa.
St. John, John H., 1298 Atlantic Ave., Brooklyn, N. Y. (Silk.)
Straus-Hohenstein Co., 133 W. 21st, New York. (Silk.)
Superior Lamp Shade Manufacturers, 72 Madison Ave., New York, N. Y. (Silk.)
Tapestrelle Corp., 44 E. 29th, New York, N. Y.
Tombs Studios, Wm. H., 172 Pennsylvania Ave., Newark, N. J. (Parchment Paper.)
Trio Mfg. Co., 610 N. American, Philadelphia, Pa. (Silk.)
Troy Art Studio, 624 2d Ave., Troy, N. Y.
Utility Shade Co., Tonafly, N. J.
Vogue Lamp & Shade Co., 130 W. 17th, New York, N. Y. (Parchment.)
Volkman Co., 3223 W. Lake, Chicago, Ill.
Wardwell, E. H., 11 E. 36th, New York, N. Y.

SHADES AND DOMES

Leaded, Mosaic or Figured, Stamped or Cast Metal.
Art Shade Co., 223 N. Desplaines, Chicago, Ill.
Badanes Mfg. Co., 62 Greene, New York, N. Y.
Bayley & Sons, 105 Vanderveer, Brooklyn, N. Y.
Handel Co., Meriden, Conn.
Mutual Sunset Lamp Co., 21 E. Houston, New York, N. Y.
Novelty Lighting Corp., 2488 E. 22nd, Cleveland, O.
Royal Art Glass Co., 2572 Park Ave., New York, N. Y.
Standard Elec. & Mfg. Co., Cedar Rapids, Ia.
Western Art Glass Shade Works, 101 Turk, San Francisco.

SHADES, FACTORY WINDOW. See Window Shades, Factory.

SHADES, Metallic

Tin, Aluminum, Brass, Copper, Zinc, Steel.
A. A. Elec. Mfg. Co., Bridgeport, Conn. (Sole selling agent, Harry Pickhardt, 129 W. 15th, New York, N. Y.)
Durex. See Wheeler Reflector Co.
Faries Mfg. Co., Decatur, Ill. (Brass, Aluminum, Tin, Copper.)
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. (Aluminum, Brass, Zinc, Iron, Steel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Aluminum, Brass, Steel, Tin.)
Miller Co., Meriden, Conn.
Monk, H. E., 18 Warren, New York, N. Y. (Tin, Aluminum, Brass, Copper, Zinc & Steel).
Oanco. See Overbaugh & Ayres Mfg. Co.
Overbaugh & Ayres Mfg. Co., 411 S. Clinton, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Western Reflector Co., 1221 W. Madison, Chicago. (Tin.)
Wheeler Reflector Co., 275 Congress, Boston, Mass.

SHADES, Mica

Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
Kant-Krack. See Huse Liberty Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co., Plumtree, N. C.
Tarmillie. See Tar Heel Mica Co.

SHAFT COUPLINGS. See Couplings, Shaft.
SHAFTS, Flexible. See Tubing, Flexible Metallic.

SHAPING MACHINES, Coil

Munaderf Company, W. P., 720 Frankfort, Cleveland, Ohio

SHEARS, Insulation

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.

SHEET STEEL CABINETS. See Cabinets, Sheet Steel.

SHELLS, Screw Socket

Chase Brass & Copper Co., Waterbury, Conn.
Patton-MacGuyer Co., Providence, R. I.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Torrington Mfg. Co., 70 Franklin, Torrington, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., 800 S. Main, Waterbury, Conn. (Miniature.)

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SHUNTS, Instruments. See Instruments, Laboratory Standard.
SIGN FLASHERS. See Flashers, Sign.
SIGN LETTER LENSES. See Lenses.

SILICA

Ottawa Silica Co., Ottawa, Ill. "Flint Shot."

SILK, Cloth Insulated. See Cloth & Paper.
Shades. See Shades, Fabric.
Tape. See Tape.
Thread. See Yarn, etc.

SILVER, Metal and Wire

Baker & Co., Inc., 54 Austin, Newark, N. J.
Handy & Harman, 57 William, New York, N. Y.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SILVER SOLDER. See Solder, Silver.
SINE WAVE OSCILLATORS. See Instruments, Laboratory Standard.
SKINNERS WIRE. See Scrapers.
SLABS, Switchboard. See Asbestos Slabs; also Molded Insulation, Slate; Soapstone.

SLATE

For Switchboard Slabs and Barriers.
Davis Slate & Mfg. Co., 618 E. 40th, Chicago, Ill.
Electrical Specialties Corp., 50 Pearl, Boston, Mass.
Fair Haven Marble & Marbleized Slate Co., Fair Haven, Vt.
Penrhyn Slate Co., Hydeville, Vt.
Portland-Munson Slate Co., Portland, Me.
Structural Slate Co., Pen Argyl, Pa.

SLEEVE-BEARINGS. See Bearings and Bushings.
SLEEVING, Cotton. See Tape, Cotton.
SLOTTING FILES. See Files, Commutator Slotting.

SLOTTING MACHINES and TOOLS, Commutator

(Mica Undercutters).
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Hobart Bros. Co., Troy, Ohio.
Hullhorst Micro Tool Co., 3240 E. Monroe, Toledo, O.
Imperial. See Martindale Elec. Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, Ohio.
Oman, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ransom & Randolph Co., Superior & Chestnut, Toledo, Ohio.
Simplex. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

SNAP SWITCHES. See Switches, Snap

SOAPSTONE

For Switchboard Slabs and Barriers.
Alberene Stone Co., 153 W. 23rd, New York, N. Y.
Lin-Stun. See Westinghouse.
Soapstone Products Co., 97 Warren, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SOCKET LININGS. See Linings, Socket.
SOCKET SHELLS. See Shells, Screw Socket.
SOCKETS, Flashing. See Flashers, Sign.

SOCKET Chain and Attachments

Pull Chain, Chain Links, Chain Adjusters, Acorns, Extensions, Insulation Chain Splicers.
Abbott. See Harvey Hubbell, Inc.
American Brass Co., 25 Broadway, New York, N. Y. (Acorns.)
Arrow Electric Co., Hartford, Conn.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Electric Co., Bridgeport, Conn.
Duplex. See Warner Bros. Co.
Eade, John E., 104 Point, Providence, R. I. Links, Insulators.
Easylite. See Rittenhouse Co., A. E.
Economy. See Harvey Hubbell, Inc.
Flory, Wm. E., 38 W. 32nd, New York, N. Y. (Decorative Pull Chains.)
Gripper. See Wittenberg Bros.
Harrigan, T. M., Woodstock, Vt. (Links.)
Hart & Hegeman Mfg. Co., Hartford, Conn. (Metal Pull Tassel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Links and Acorns. Metal Pull Tassels.)
Paiste. See Hart & Hegeman Mfg. Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y. (Pull Chain Tassel.)
P. & S. See Pass & Seymour, Inc.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Royal. See Sears, Henry D.
Scovil Mfg. Co., Waterbury, Conn. (Acorn.)
Sears, Henry D., 50 Boylston, Boston, Mass.
Weber. See Sears, Henry D.
Wittenberg Bros., 60 Shipman, Newark, N. J. Links, Insr.

SOCKET REDUCERS

Arrow Elec. Co., Hartford, Conn.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Can-del-lite. See Sears, Henry D.

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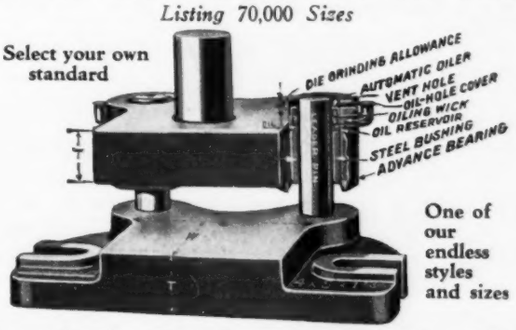

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Eagle Electric Mfg. Co., 59 Hall, New York, N. Y.
Electric Co., 94 Allyn, Hartford, Conn.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York, N. Y.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sears, Henry D., 80 Boylston, Boston, Mass.

SOCKETS, Radio. See Radio Receiver Parts.

SOCKETS AND RECEPTACLES, Lamp

Bases other than Standard (or Medium) are indicated as follows: Mogul, M; Candelabra (or Miniature), C.

Key ..... See K.
Composition ..... See W
Metal Shell ..... See B
Porcelain ..... See A
Pull Chain ..... See P
Push Through ..... See T
Sign Receptacles ..... See A

A. B. C. See Leviton Mfg. Co.
Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... A
Alabax. See Arrow Elec. Co.
Appleton Electric Co., 1750 Wellington Ave., Chicago, Ill. ..... A
Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa. ..... A
Arrow Elec. Co., Hartford, Conn. ..... M C K T P B A
Arrogrip. See Arrow Elec. Co.
A. & W. See General Outdoor Adv. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. ..... C . . . . P B .
Best. See United States Elec. Mfg. Corp.
Bryant Elec. Co., Bridgeport ..... M C K T P B A
C-H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. ..... M . . K T P B A
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. .....
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... M . . K T . . B A
Crouse-Hinds Co., Syracuse, N. Y. ..... A W . . . . . .
Cutler-Hammer Mfg. Co., 1237 St. Paul Ave., Milwaukee, Wis. .... K T . . B A
Durex. See Wheeler Reflector Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. .....
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... P B . .
Far-Go Elec. Mfg. Co., 368 Broome, New York, N. Y. ..... C . . . . . .
Federal Electric Co., 8700 S. State, Chicago, Ill. ..... A
Flute. See Pass & Seymour.
Flutelier. See Pass & Seymour.
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. ..... M C . . . . . B . .
Gaynor Elec. Co., Bridgeport, Conn. ..... A
General Elec. Co., E. M. 12, Merchandise Dept., Bridgeport, Conn. .. M C K T P B A
Glow Elec. Co., 22 Queens, Long Island City, N. Y. ..... M . . . . . B . .
Hart & Hegeman Mfg. Co., Hartford, Conn. ..... M C K T P B A
Hoosick Falls Radio & Elec'l Parts Mfg. Co., Hoosick Falls, N. Y. ..... W . . . . . .
Hubbell, Inc., Harvey, Bridgeport, Conn. M C K T P B A
H. & H. See Hart & Hegeman.
I-D-A. See Watson Mfg. Co., J. E.
K-E Cleat Receptacle. See Kirkman.
Kirkman Engineering Co., 1 Dominick, New York. (Cleat Receptacle.) .....
Leader. See Leviton Mfg. Co.
Leiser & Co., W. A., 1607 Sansom, Philadelphia, Pa. ..... A
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y. ..... M C K . . P B A
Levolier. See McGill Mfg. Co.
Liberty Bell. See Hart & Hegeman.
Locat-A-Catch. See Connecticut.
McGill Mfg. Co., Valparaiso, Ind. ..... P B A
Majestic Elec. Mfg. Co., 806 N. 12th, St. Louis. (Lamp Receptacle.) ..... A
Meteor Elec. Corp., 499 E. 70th, New York, N. Y. ..... K . . P . . . .
Molded Socket Corp., Railroad, Pa. ..... K . . . . . .
Multi Elec'l Mfg. Co., 210 N. Ogden Ave., Chicago, Ill. ..... A
Multilok. See Circle F Mfg. Co.
Newgard. See Multi Elec'l Mfg. Co.
New Wrinkle. See Bryant Elec.
Noark. See Colt's Patent Fire Arms.
One 4 All. See Propp Co., M.
P. & S. See Pass & Seymour.
Pass & Seymour, Solvay Station, Syracuse, N. Y. ..... M C K T P B A
Paulding, John I., New Bedford, Mass. ..... B A
Perkins. See Bryant Elec. Co.
Porcelain Products, Inc., Findlay, O. ..... A
Propp Co., M., 524 Broadway, New York, N. Y. .....
Quick Catch. See Hubbell, Inc.
Ratner Elec. Mfg. Co., 195 Morgan Ave., Brooklyn, N. Y. ..... M . . . . . P B . .
Roberts Elec. Mfg. Co., 211 Centre, New York, N. Y. (Candle.) ..... T . . B . .
Royal. See Sears, Henry D.
Safti Sbe. See Molded Socket Corp.
Sears, Henry D., 80 Boylston, Boston M C K T P B A
Security. See Circle F Mfg. Co.
Shurlock. See Pass & Seymour.
Siemen Co., Bridgeport, Conn. .....
Taplet Mfg. Co., 3709 Powelton Ave., Philadelphia, Pa. ..... A
TEC. See Electric Company.
Titan. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. ..... A A
Union Insul. Co., Parkersburg, W. Va. .....
United States Elec. Mfg. Corp., 222 W. 14th, New York, N. Y. ..... P . . B . . W
U. S. Electric Co., 311 Chambers St., Trenton, N. J. ..... A
Walco. See Leiser & Co., W. A.
Waterbury Button Co., Waterbury, Conn. .....
Watson Mfg. Co., J. E., 5506 N. Fifth, Philadelphia, Pa. (Concealed Fixture) ..... P B . .

Weber. See Sears, Henry D.
Wheeler Reflector Co., 275 Congress St., Boston, Mass. ..... P . . . .
Wiring Devices, Inc., 5 High, Trenton, N. J. ..... A
Wood Electric Co., C. D., 565 Broadway, New York. (Sign Receptacles.) ..... A
Woodwin. See Wood Elec. Co.
Wrinklet. See Bryant Elec. Co.

SOLDER, Aluminum

Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Platt Bros. & Co., Waterbury, Conn.
Union Smelting & Refining Co., Newark, N. J.
Usarco. See Union Smelting & Refining Co.

SOLDER, Bar and Wire

Eagle. See Hoyt Metal Co.
Genuine A. See Hoyt Metal Co.
Hoyt Metal Co., St. Louis, Mo.

SOLDER, Self-Fluxing

American Solder & Flux Co., 2910 N. 16th, Philadelphia.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Dutch-Boy. See National Lead Co.
Gardiner Metal Co., 1366 W. Lake, Chicago, Ill.
Kester. See Chicago Solder Co.
Lenk Mfg. Co., 32 Merrimac, Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Tinol. See American Solder & Flux Co.

SOLDER, Silver

Handy & Harman, 57 William, New York, N. Y.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SOLENOIDS. See Coils, Finished.

SOLDERING
Compounds. See Soldering Compounds.
Irons. See Soldering Irons.
Machines. See Soldering Machines, Commutator
Tools. See Torches and Furnaces.

SOLDERING COMPOUNDS

Stick Paste, Flux Salts, Fluid.
Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill. (Soldering, Stick Paste, Salts, Liquid Oil, Welder, Aluminum Flux, Fountain Brushes.)
American Solder & Flux Co., 2910 N. 16th, Philadelphia, Pa. Flux, Paste, Salts.
Ameo. See American Solder & Flux Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Benson Co., Alex R., Hudson, N. Y. (Salts and Paste.)
Burnley Battery & Mfg. Co., North East, Pa. Paste and Stick.
Brubner Chemical Wks., 217 E. 3rd, Cincinnati, O.
Callahan & Co., Geo., 218 Front, New York. (Fluid.)
Central Stamping Co., 206 Broadway, New York, N. Y. Paste and Salts.
Challenge. See Highland Electro Chemical Co.
Conductalute. See Technical Products Co.
Crescent. See McGill Mfg. Co.
Diamond. See Burnley Battery & Mfg. Co.
Dielectric Mfg. Co., St. Louis, Mo.
Dunton Co., M. W., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Eureka. See Grasselli Chemical Co.
Firth Radio Corp., 25 Beaver, New York, N. Y.
Fluxite. See Monarch Products Co.
General Elec. Co., E. M. 12, Merchandise Dept., Bridgeport, Conn. (Paste.)
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Highland Electro Chemical Mfg Co., Connellsville, Pa. (Paste, Stick, Salts.)
Incomparable. See Reade Mfg. Co.
Leveridge, Chas. W., 246 Fulton, New York, N. Y.
Lilco. See Lukens Metal Co.
Lukens Metal Co., T. F., 1105 Fairmount Ave., Philadelphia, Pa.
McGill Mfg. Co., Valparaiso, Ind. Fluid.
Mitchell-Rand Mfg. Co., 19 Vesey, New York. (Paste.)
Monarch Products Co., Red Bank, N. J.
Neer Co., L. F., Butler, O. (Flux and Solution.)
Neutral. See Dielectric Mfg. Co.
New-Idea. See Hartwig Co., Wm. J.
Nokorode. See Dunton Co., M. W.
Oakwood. See Weaver Specialty Co.
Parsons Insulating Co., 5716 Euclid Ave., Cleveland, O.
Perfecto. See Firth Radio Corp.
Pfanstiehl Chemical Co., Waukegan, Ill. Paste, Salts, Sticks, Fluid, Oil, and Solid Sal Ammonica.
Queens. See Brunner Chemical Works.
Reade Mfg. Co., 133 Hoboken Ave., Jersey City, N. J. (Fluids, Salts, Paste).
Redens. See Reade Mfg. Co.
Red-Letter. See Ruby Chemical Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y. (Paste.)
Rotax Mfg. Co., 380 E. 133rd, New York, N. Y.
Ruby Chemical Co., Columbus, O.
Ruby Fluid. See Ruby Chemical Co
Salbrick. See American Solder & Flux Co.
Silva-Wares, Inc., 134 W. 26th, New York, N. Y.
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. (Paste.)
Snowflake. See Grasselli Chemical Co.
Snowflake. See Highland Electro Chemical Co.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Solderine. See Central Stamping Co.
Solderite, Inc., 22 Green, Newark, N. J.
Speco. See Pfanstiehl Chemical Co.
Standard. See Grasselli Chemical Co.
Star. See McGill Mfg. Co
Superior. See Highland Electro Chemical Co.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh Pa. (Paste).
Tinol. See American Solder & Flux Co.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago, Ill.
Weaver Specialty Co., 6344 Aurelia, Pittsburgh, Pa.
Yager's. See Benson Co., Alex R.
Yankee. See Leveridge, Chas. W.

SOLDERING IRONS

Acme Elec. Heating Co., Dept R, 1217 Washington, Boston.
Adrolt. See Adrola Corp.
Adrola Corp., Port Jefferson, N. Y.
American Beauty. See American Elecl. Heater Co.
Americal Elecl. Heater Co., Detroit, Mich.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beckwith Machine Co., Ravenna, Ohio.
Betsy Ross. See Central Flatiron Mfg. Co.
Bode. See Baco Electric Co.

Brach Mfg. Corp., L. S., Newark, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Central Flatiron Mfg. Co., Johnson City, N. Y.
Chapman Machine Co., Terryville, Conn.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Davis Specialty Works, East Gary, Ind.
Dominion Elec'l Mfg. Co., 712 Ontario Ave., N., Minneapolis.
Dover Mfg. Co., Dover, O.
Drake Elec. Wks., 3943 Lincoln Ave., Chicago, Ill.
Edison Elec. Appliance Co., 5600 W. Taylor, Chicago, Ill.
Electrahot Mfg. Co., 525 S. 4th, Minneapolis, Minn.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland. (Transformer Soldering Outfit.)
Electric Soldering Iron Co., 124 W. 18th, New York.
Electrical Products Mfg. Co., Providence, R. I.
Enox. See Electrical Necessities Corp.
Esico. See Electric Soldering Iron Co.
Everhot. See Swartzbaugh Mfg. Co.
Ever-Ready. See Gold Seal Elec. Co.
General Electric Co., Schenectady, N. Y.
Gold Seal Elec. Co., 250 Park Ave., New York, N. Y.
Home. See Majestic Elec. Appliance Co.
Illinois Stamping & Mfg. Co., 220 N. Jefferson, Chicago, Ill.
Industrial. See Permway Mfg. Co.
Jiffy. See Koch & Co., Paul W.
Junior. See Drake Elec. Wks.
King. See Electric Heat Control Co.
Koch Co., Paul W., 23 S. Wells, Chicago. (Solder Dipper.)
Landers, Frary & Clark, New Britain, Conn.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Lotan. See Simplex Flux & Solder Co. of America.
Lucifer. See Jones Point Tool & Elec. Co.
McAdams Co., J. C., Long Island City, N. Y.
Majestic Electric Appliance Co., San Francisco, Cal.
Manning-Bowman & Co., Meriden, Conn.
Mechanics. See Drake Elec. Wks.
Moto-Ray Mfg. Co., 169 Massachusetts Ave., Boston, Mass.
National Specialties Co., Howell & Tyler Sts., Fort Wayne, Ind.
Northern Elec. Co., 2833 N. Western Ave., Chicago, Ill.
Nu-Way. See McAdams Co.
Queen Quality. See Watlow Elec. Mfg. Co.
Quick-Hot. See Moto-Ray Mfg. Co.
Radio See Drake Elec. Wks
Regular. See National Specialties Co.
Reliance. See Landers, Frary & Clark.
Samson Cutlery Co., 8 Jones St., Rochester, N. Y.
Security Elec. Mfg. Co., 2633 Canton, Chicago, Ill.
Silver King. See Illinois Stamping & Mfg. Co.
Simplex Flux & Solder Co. of America, 1965 E. 66th, Cleveland, O.
Superior Elec. Products Co., 1300 S. 13th, St. Louis, Mo.
Swartzbaugh Mfg. Co., 1501 W. Bancroft, Toledo, O.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trent, Harold E., 295 N. Lawrence, Philadelphia, Pa.
Varick Elec. Mfg. Co., 28 E. 21st St., New York, N. Y.
Vulcan Elec. Heating Co., 225 Varick, New York, N. Y.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago, Ill.
Ward Mfg. Co., 937 Wellington Ave., Chicago, Ill.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Wellmade Elec. Co., Torrington, Conn.

SOLDERING MACHINES, Commutator

(For production soldering of small commutators).
Allatonce. See Chapman Electric Works, P. E.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.

SOLENOIDS. See Coils
SOLVENTS & REDUCERS, VARNISH. See Paint, Varnish, Lacquer.
SPAGHETTI. See Tubing, Varnished Fabric.
SPEED CHANGING UNITS. See Gears (Speed Changing Units).
SPEED INDICATORS. See Tachometers.
SPOOLING MACHINES, WIRE. See Wire Manufacturing Machines.

SPRAYING OUTFITS

Airway. See Binks Spray Equip. Co.
Babco. See Simons Paint Spray Brush Co.
Binks Spray Equipment Co., 3120 Carroll Ave., Chicago, Ill.
De Vilbiss Mfg. Co., 3750 Detroit Ave., Toledo, Ohio.
Electric Sprayit Co., 320 E. Colfax Ave., South Bend, Ind.
Eureka Pneumatic Spray Co., 87 130th, Richmond Hill, N.Y.
Ideal Air Brush Mfg. Co., 203 Lafayette, New York, N. Y.
Kellogg Mfg. Co., 97 Humboldt, Rochester, N. Y.
Metal Specialties Mfg. Co., 338 N. Kedzie Ave., Chicago.
Macleod Co., 2232 Bogen, Cincinnati, O.
Paasche Air Brush Co., 1911 Diversey Parkway, Chicago, Ill.
Presto. See Metal Specialties Mfg. Co.
Simons Paint Spray Brush Co., 1017 Maryland Ave., Dayton, O.
Simplex Spray Equipment Co., 552 W. Lake, Chicago, Ill.
Sprayit. See Electric Sprayit Co.
Wold Air Brush Mfg. Co., 2173 N. California Ave., Chicago, Ill.

SPREADERS, COIL & LOOP. See Winding Machines. Armature & Field Coil.

SPRING MAKING MACHINES

Sleeper & Hartley, Inc., Worcester, Mass.

SPRINGS,

Advance Spring & Wire Co., 1749 Carroll Ave., Chicago.
Barnes-Gibson-Raymond, Inc., 6400 Miller Ave., Detroit, Mich.
Cary Spring Works, Inc., 240 W. 29th St., New York, N. Y.
Chapin Co., Chas. E., 227 Fulton, New York, N. Y.
Cleveland Wire Spring Co., Cleveland, O.
Cook Spring Co., Ann Arbor, Mich.
Cuyahoga Spring Co., Beres Rd., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Elby Mfg. Co., H. H., 4710 Stanton Ave., Philadelphia, Pa.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Gibson Co., Wm. D., 1800 Clybourn Ave., Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Landsdale, Pa.
Lee Spring Co., 34 Main, Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge, Brooklyn, N. Y.
Newcomb Spring Corp., 234 40th, Brooklyn, N. Y.
Peck Spring Co., Plainville, Conn.
Peterson Spring Co., 1660 Beard Ave., Detroit, Mich.
Rapid Spring Co., 222 Second Ave., Pittsburgh, Pa.
Raymond Spring Co., Corry, Pa.
Standard Spring and Manufacturing Co., 236-42nd St., Brooklyn, N. Y.
Steinen & Co., 297 Washington, Newark, N. J.

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STAMPED BOXES. See Cabinets, Sheet Steel.

STAMPINGS, Fibre. See Fibre.
Sheet Metal. See Fixture Fittings.
Sheet Steel. See Stampings, Sheet Steel.
Small. See Stampings, Small.

STAMPINGS, Sheet Steel

Heavy Stamping and Drawing.
Acklin Stamping Co., 1925 Nebraska, Toledo, O.
American Stamping Co., 978 E. 64th, Cleveland, O.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Boesert Corp., Utica, N. Y.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee,
Hubbard & Co., Pittsburgh, Pa.
Janney, Steinmetz & Co., 1421 Chestnut St., Philadelphia.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn.
Mullins Mfg. Corp., Washing Machine Division, Salem, Ohio. (Vitreous Enameled)
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
Truscon Steel Co., Youngstown, O.

STAMPINGS, Small

Small Stamped Metal Parts for Electrical Devices.
Advance Tool & Die Casting Co., 1654 Holton, Milwaukee,
Aerial Machine & Tool Co., 79 Grand, New York, N. Y.
American Emblem Co., Utica, N. Y.
American Radio Hardware Co., 135 Grand, New York, N. Y.
American Stamping Co., 978 E. 64th, Cleveland, O.
Arrow Automatic Products Corp., 27 Vestry, New York, N. Y.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Bull Dog Electric Products Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
Clarke Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee,
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros. Co., Piano, Ill.
Hubbard Spring Co., M. O., Pontiac, Mich.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Kelly Brass Wks., 226 W. Ontario, Chicago, Ill.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Lansing Stamping Co., Lansing, Mich.
Lenz Metal Stamping Wks., J., 199 Franklin, New York.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Mutual. See Bull Dog Elec. Products Co.
Patton-MacGuyer Co., Providence, R. I.
Paul & Beekman Mfg. Co., 1734 N. Fifth, Philadelphia, Pa.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Premax Products, Inc., Niagara Falls, N. Y.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Reliance Die & Stamping Co., 501 N. La Salle, Chicago.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Signal Elec. Mfg. Co., 1904 Broadway, Menominee, Mich.
Steinen & Co., 297 Washington, Newark, N. J.
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
United Stamping & Mfg. Co., Cleveland, Ohio.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Waterbury Metal Wares Co., Waterbury, Conn.
Zierick Machine Wks., F. R., 6 Howard, New York, N. Y.

STANDS, Armature

Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17 & Cambria Sts., Philadelphia, Pa.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

STARTERS, Motor. See Controllers, Motor; Switches, Remote Control; Switches, Knife; Safety; Switches, Snap (Heavy Duty).

STEATITE. See Cores, Resistance Coil.

STEEL CASTINGS. See Castings, Steel.

STEEL for Electric Appliances

Elyria Iron & Steel Co., Elyria, O.
Ryerson & Son, Jos., 2558 W. 16th, Chicago, Ill.

STEEL, Magnet

Ajax Electrothermic Corp., Trenton, N. J.
Hercules Elec. Steel Corp., 145 Lafayette St., New York.
Indiana Steel Products Co., 4545 S. Western Ave., Chicago.
Ludlum Steel Co., Watervliet, N. Y.

STEEL SHEETS

Agathon. See Central Alloy Steel Corp.
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middleton, Ohio.
American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh.
Armelec. See Empire Steel Corp.
Central Alloy Steel Corp., Massillon, O.
Cyclops Steel Co., Titusville, Pa.
Dynelec. See Empire Steel Corp.
Empire Steel Corp., Mansfield, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Manelec. See Empire Steel Corp.
Metelec. See Empire Steel Corp.
Newport Rolling Mill Co., Newport, Ky.
Polelec. See Empire Steel Corp.
Republic Iron & Steel Co., 335 Market, Youngstown, O.
Tranelec. See Empire Steel Corp.
Unilloy. See Universal Steel Co.
Universal Steel Co., Bridgeville, Pa.
Wheeling Steel Corp., Wheeling, W. Va.

STEEL, STRIP. See Strip Steel.

STOCKS, Dies and Reamers

Hall-Will, Inc., Erie, Pa.
Red-E-Hall. See Hall-Will, Inc.
Toledo Pipe Threading Machine Co., 1445 Summit, Toledo, O.

STONES, Commutator

Acme. See Green Equipment Corp.
Caro. See Electric Service Supplies Co.
Cleveland Stone Co., Union Trust Bldg., Cleveland, O.
Co-operative Utilities Co., 15th & Columbia Ave., Philadelphia, Pa.
Diamond Dee. See Co-operative Utilities Co.
Electric Service Supplies Co., 17th and Cambria, Philadelphia, Pa.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1008 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Lombard & Co., Somerville, Mass.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.

STOOLS, Factory; Steel

Angle Steel Stool Co., Plainwell, Mich.

STORAGE
Battery Plates. See Plates, Storage Battery.
Battery, Separators. See Separaters.
Tools. See Tools, Storage Battery.

STRAINING MACHINES, INSULATION. See Wire Manufacturing Machines.

STRAIGHTENERS, Armature Shaft

Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

STRANDING MACHINES. See Wire Manufacturing Machines.

STRIP STEEL

Acme Steel Co., 2840 Archer Ave., Chicago, Ill.
Republic Iron & Steel Co., 335 Market, Youngstown, O.

STRIPPERS, Wire

Acme. See A. Laubscher.
Artos Engineering Co., 69 Wisconsin, Milwaukee, Wis. (Cutting, Stripping and Measuring).
Austin Co., M. B., 108 S. Desplaines, Chicago, Ill.
Dicke Tool Co., Downers Grove, Ill.
E-Z. See Pyramid Products Co.
F. F. See France Mfg. Co.
Foley Saw Tool Co., 655 Foley Bldg., 9 Main, N. E., Minneapolis, Minn. (Bench Type Wire Stripper.)
France Mfg. Co., 10325 Berea Rd., Cleveland. (Motor Driven.)
Goehst. See Klein & Sons.
Hartman. See Service Sales & Mfg. Co.
Ives Mfg. Co., Meriden, Conn.
Klein & Sons, Mathias, Chicago, Ill.
Laubscher, A., 77 Fort Pleasant Ave., Springfield, Mass.
Service Sales & Mfg. Co., 17005 Melgrave Ave., Cleveland, Ohio.
Zierick Machine Wks., F. R., 6 Howard, New York City. (Motor Driven Stripper & Twister).

SWITCHBOARD INSTRUMENTS. See Instruments, Portable and Switchboard.

SWITCHBOARDS, SLABS AND BARRIERS
See Asbestos Slabs; Molded Insulation; Slate; Soapstone.

SWITCH (Switches)
Arms. See Posts, Binding.
"Across the Line" Type. See Controllers, Motor.
Baby Knife. See Switches, Battery.
Battery. See Switches, Battery.
Canopy. See Switches, Snap.
Clock Operated. See Switches, Time.
Feed Through. See Switches, Snap.
Fixture. See Switches, Snap.
Float. See Switches, Tank.
Flush. See Switches, Snap.
Handles. See Handles, Wood
Knife, Baby. See Switches, Battery & Baby Knife.
Lever Radio. See Radio Mounting.
Lever. See Switches, Snap, Lever.
Limit. See Controllers, Motor.
Mercury. See Switches, Mercury
Motor Starting. Magnetic Type. See Controllers.
Motor Starting. Non-Magnetic. See Switches, Motor Starting.
Pendant. See Switches, Snap.
Pressure Regulating. See Controllers.
Push Button, Snap. See Switches, Snap.
Push Button, Motor Starting. See Switches, Remote Control.
Radio Receiver. See Radio Mountings.
Range. See Switches Snap; Heavy Duty
Remote Control. See Switches, Remote Control.
Reversing. See Controllers.
Rotary. See Switches, Snap.
Safety. See Switches, Knife.
Snap. See Switches, Snap.
Starter Type. See Controllers.
Storage Battery. See Switches, Storage Battery.
Surface. See Switches, Snap.
Tank. See Switches, Tank
Time. See Switches, Time.
Toggle. See Switches, Snap.
Tumbler. See Switches, Snap.

SWITCHES, Battery and Baby Knife

Cut-Out Switches.
Anti-Wood. See Kell & Son, Francis.
Bridgeport Switch Co., 209 Center, Bridgeport, Conn.
Bryant Electric Co., Bridgeport, Conn.
Chapman. See Frank W. Morse & Co.
Chicago Elec. Mfg. Co., 2801 S. Halsted, Chicago, Ill.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Crown. See Edwards & Co., Inc.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Edwards & Co., Inc., 140th & Exterior, New York, N. Y.
Electrad, Inc., 428 Broadway, New York, N. Y.
Eureka. See Frank W. Morse & Co.
Fahnestock Elec. Co., cor. East Ave. and 8th, Long Island City, N. Y.
Handy. See Chicago Elec. Mfg. Co.
H. & H. See Hart & Hegeman Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn. (Push Button.)
Harwood. See Frank W. Morse & Co.
Heinemann Elec. Co., Philadelphia, Pa.
Jost. See Frank W. Morse & Co.
Kappa. See Trumbull Elec. Mfg. Co.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y.
Kendrick & Davis Co., Lebanon, N. H.
Keystone. See Frank W. Morse & Co.
King Mfg. Co., B. C., 302 Park Ave., Brooklyn, N. Y.
Knox Porcelain Corp., Knoxville, Tenn.
K-P-F Elec. Co., 855 Howard St., San Francisco, Cal.
Kurz & Root, Appleton, Wis.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Lyons Mfg. Co. (Mt. Carmel), New Haven, Conn.
Majestic Elec. Mfg. Co., 80 N. 12th St., St. Louis, Mo.
Manhattan Elec'l Supply Co., 17 Park Pl., New York, N. Y.
Morse Co., Frank W., Boston, Mass.
Partrick & Wilkins Co., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, Ohio.
Powerlite Switchboard Mfg. Co., 4149 E. 79th, Cleveland, O.
Pullrite. See Frank W. Morse & Co.
Reliable Electric Co., 3145 Carroll Ave., Chicago, Ill.
Samson Electric Co., Canton, Mass.
Spero Elec. Mfg. Co., E. 33rd and Woodland Ave., Cleveland
Sta-Rite. See Frank W. Morse & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Wood Elec. Co., C. D., 565 Broadway, New York, N. Y.

SWITCHES, Mercury

(For Temperature Control Apparatus.)
Absolute Con-Tac-Tor Corp., Elkhart, Ind.
Con-Tac-Tor. See Absolute Con-Tac-Tor Corp.
Cooper Hewitt Electric Co., 410 Eighth, Hoboken, N. J.
Cramblett Engineering Corp., 286 Milwaukee, Milwaukee.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
General Kontroler Co., 200 E. First, Dayton, O.
Hywatt. See Cramblett Engr. Co.

Kon-nec-tor. See Cooper Hewitt Elec. Co.
Kontax. See General Kontroler Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.

SWITCHES, Motor Starting

Accessible. See Trumbull-Vanderpoel Elec. Mfg. Co.
Aces. See Colt's Patent Fire Arms Mfg. Co.
Adam Elec. Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Barber Elec. Mfg. Co., North Attleboro, Mass.
Bull Dog Electric Products Co., Detroit, Mich.
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Crouse-Hinds Co., Syracuse, N. Y.
E. W. See Trumbull Elec. Mfg. Co.
FA. See Adam Elec. Co., Frank.
F. A. Triumph. See Metropolitan Elec. Mfg. Co.
Federal Steel Products Co., 2 Ave. L., Newark, N. J.
Large-Dail Mfg. Co., 606 Cherry, Philadelphia, Pa.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lundy Co., E. A., Fulton Bldg., Pittsburgh.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Major. See Adam Elec. Co., Frank.
Mason. See Trumbull-Vanderpoel Elec. Mfg. Co.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
Metropolitan Elec. Mfg. Co., Blvd. at 14th, Long Island City, N. Y.
Murray. See Metropolitan Device Corp.
Mutual. See Bull Dog Elec. Products Co.
Naro. See Metropolitan Elec. Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Nublade. See Colt's Patent Fire Arms Mfg. Co.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Robbins & Myers, Inc., Springfield, O.
Safe-Lock. See Trumbull-Vanderpoel Elec. Mfg. Co.
Safelock. See Westinghouse Elec. & Mfg. Co.
Schmuckler & Sons, 2232 N. 28th, Philadelphia, Pa.
Square D Co., Detroit, Mich.
S. S. See Wadsworth Elec. Mfg. Co.
Tanner & Co., Wm. F., 511 Sharp, Baltimore, Md.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
T. V. Safelock. See Trumbull-Vanderpoel Elec.
Unisafti. See Metropolitan Device Corp.
Unit-Versal. See Bull Dog Elec. Products Co.
Universal Metal Box & Products Co., 316 Colt, Irvington, N. J.
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegmann & Co., E. M., 3611 N. 11th, St. Louis.

SWITCHES, Remote Control

Push Button, Magnetically Operated.
Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Cutler-Hammer Mfg. Co., 1287 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Dunco. See Struthers Dunn, Inc.
General Electric Co., E. M. 12, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
H. P. See Palmer Elec. & Mfg. Co.
Industrial Controller Co., Milwaukee, Wis.
Kato Engr. Co., Mankato, Minn.
Major, F. A., System. See Adam Elec. Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Precise Mfg. Co., 254 Mill, Rochester, N. Y.
Protectoswitch. See Precise Mfg. Co.
R. C. O. C. See South Bend Current Controller Co.
Sauter. See Cramer & Co., R. W.
Signal Engineering & Mfg. Co., 146 W. 14th, New York.
South Bend Current Controller Co., South Bend, Ind.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Takamine Corp., 208 Rawson St., Long Island City, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore.
Triplock. See Monitor Controller Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

SWITCHES, Snap

KEY

Feed Through ..... See p
Fixture (Canopy, Candelabra and Key Arm) ..... See F
Flush ..... See f
Lever, Toggle, Tumbler ..... See L
Pendant ..... See p
Push Button ..... See P
Rotary ..... See R
Surface ..... See s

See Also Switches, Snap; Heavy Duty.

Adam Electric Co., Frank, St. Louis, Mo. f . . . . . .
Anylite Elec. Co., Ft. Wayne, Ind. . . . . L . .
Arrow Electric Company, Hartford, Conn. f sp P R L F
Arrow Head. See Arrow Elec. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. . . . . f p P . . . . F
Best. See United States Elec. Mfg. Corp.
Brascolite. See Guth & Co., Edwin.
Bremer Elec. Mfg. Co., 139 N. 7th, Philadelphia, Pa. . . . . f . . . . . .
Bridgeport Switch Co., 209 Center, Bridgeport, Conn. . . . . L F
Bryant Elec. Co., Bridgeport, Conn. . . . . f sp P R L F
B. S. Co. See Bridgeport Switch Co.
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn. . . . . F
Circle F. Mfg. Co., Trenton, N. J. . . . . f . . P . . L F
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. . . . . p P R L F
Crouse-Hinds Co., Syracuse, N. Y. . . . . L . .
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis. . . . . P . . . . L . .
Diamond H. See Hart Mfg. Co.
Dugle. See Bryant Elec. Co.
Economy Fuse Mfg. Co., 2717 Greenview Ave., Chicago, Ill. . . . . F
Gaynor Elec. Co., Bridgeport, Conn. . . . . f . . . . . L . .
General Elec. Co., E. M. 12, Merchandise Dept., Bridgeport, Conn. . . . . f sp P R L F
Glo-Guide. See Bryant Elec. Co.
Gold Star Push Switch. See Hart & Hegeman.
Guth & Co., Edwin, 2615 Washington Ave., St. Louis, Mo. . . . . F
Hart Mfg. Co., Hartford, Conn. . . . . f sp P R L . .
Hart & Hegeman Mfg. Co., Hartford, Conn. (Door Bolt Control.) . . . . . f sp P R L F
Hart. See Hart & Hegeman Mfg. Co.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Inc., Harvey, Bridgeport, Conn. . . sp . . . . L F
Jost. See Morse, Frank W.

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BOSTON

SWITCHES, Snap—Continued
Keil & Son, Francis, 401 E. 163rd, New York, N. Y. ..... f .. P .. .. ..
Leviton Mfg. Co., 236 Newell, Brooklyn .. .. F
Lewellar. See McGill Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. ..... f .. .. .. L F
Marks Products Co., 80 N. Ninth, Brooklyn, N. Y. ..... L F
Matropolitan Elec. Mfg. Co., Blvd at 14th St., Long Island City, N. Y. ..... s .. R .. ..
Morse Co., Frank W., 291 Congress, Boston .. .. P .. .. ..
National. See Standard Elec. Mfg. Co.
New England. See Paulding, John L.
Nutmeg. See Hubbell, Harvey, Inc.
Operite. See Morse Co., Frank W.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. ..... f sp P .. L F
Paulding, John L., New Bedford, Mass. .... f s P .. .. ..
Pen Tap. See Beaver Mfg. Co.
Perkins. See Bryant Elec. Co.
Pilot Electric Mfg. Co., 323 Berry, Brooklyn, N. Y. ..... L ..
Piloteggle. See Pilot Elec. Mfg. Co.
Pullrite. See Morse, Frank W.
Ratner Elec. Mfg. Co., 195 Morgan Ave., Brooklyn, N. Y. ..... F
Roberts Elec. Mfg. Co., 2-1 Centre, New York, N. Y. ..... F
Rodale Mfg. Co., 200 Hudson, New York p .. ..
Sears, Henry D., 80 Boylston, Boston .. f sp P R L F
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa. ..... P .. .. ..
Snapit. See Marks Products Co.
Spartan. See Bryant Elec. Co.
Standard Elec. Mfg. Co., 941 Wrightwood Ave., Chicago, Ill. ..... f s P R L ..
Trigle. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. f s P R L ..
Twi-Lite. See McGill Mfg. Co.
United States Elec. Mfg. Corp., 222 W. 114th, New York, N. Y. ..... f .. ..
Victor. See Keil & Son, Francis.
Weber. See Sears, Henry D.
Wood Electric Co., C. D., 565 Broadway, New York, N. Y. ..... F
Workrite. See Morse, Frank W.
Yankee. See Bryant Elec. Co.

SWITCHES, Snap; Heavy Duty

Heavy duty rotary snap switches for Electric Range and Small Motor Control.

Arrow Electric Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
Diamond H. See Hart Mfg. Co.
Domestic Electric Co., 7723 St. Clair Ave., Cleveland, Ohio.
General Electric Co., E. M. 12, Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.

SWITCHES, Storage Battery; Automatic Disconnecting

Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Penn Electric Machine Co., Des Moines, Ia.
Radioloc. See Cutler-Hammer Mfg. Co.

SWITCHES, Tank

Automatic Appliance Co., 226 N. St. Clair, Dayton, Ohio.
Blackburn-Smith Corp., 25 W. 45th, New York, N. Y.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Electrical Repair Co., 240 W. 25th, New York, N. Y.
General Electric Co., Schenectady, N. Y.
Industrial Controller Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Leader-Trahern Products Co., Decatur, Ill.
Ostrander Elec. Wks., W. R., 911 Atlantic Ave., Brooklyn.
Penn Elec. Switch Co., 20th & Walnut, Des Moines, Ia.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, Time (Automatic Clock Operated Switches)

Anderson Mfg. Co., Albert & J. M., 220 A, Boston, Mass.
Astrachron. See Gem Engineering Co.
Automatic Elec. Heater Co., 1505 Race, Philadelphia, Pa.
Automatic Elec. Mfg. Co., Mankato, Minn.
Automatic Lighting Co., 831 Greenmount Ave., Baltimore.
Automatic Sprinkler Corp. of America, 910 B. of L. E. Bank Bldg., Cleveland, Ohio.
Automatic Timer Co., 1841 Euclid Ave., Cleveland, O.
Berry, A. Hall, 73 Murray, New York, N. Y.
Brown & Pengilly, Inc., 1264 Folsom, San Francisco, Cal.
Cackle. See Berry A. Hall.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Clark. See Automatic Heater Co.
Cleveland. See D. J. Time Switch Co.
Con-tac-tor. See Absolute Con-tac-tor Corp.
Cramer & Co., B. W., 136 Liberty, New York, N. Y.
D-J Time Switch Co., 1306 E. 14th, Cleveland, O.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Frisch, Walter P., 104 Linden, Rochester, N. Y.
Gem Engineering Co., Hempstead, N. Y.
General Electric Co., Schenectady, N. Y.
Go-N-Set. See G. & S. Research Lab.
G. & S. Research Laboratory, 1269 Cochran Ave., Los Angeles, Cal.
Hart Mfg. Co., Hartford, Conn.
Hartford. See Berry A. Hall.
Horni Signal Mfg. Co., 290 Hudson, New York, N. Y.
Knowles, W. E., 2869 Broadway, Oakland, Cal.
Kwixset. See Thompson Clock Co.
Lamp-Lighter. See Robbins & Myers Co.
Liberty Bell Mfg. Co., Minerva, Ohio.
Mercury Time Switch Co., Marine City, Mich.
Northwestern Clock Co., Omaha, Neb.
Ohio Time Switch Co., 1439 St. Clair Ave., Cleveland.
Paragon Elec. Co., 409 S. Dearborn, Chicago, Ill.
Racine. See Reliance Automatic Ltg. Co.
Radio Owl, 2269 E. 51st, Los Angeles, Cal.
Reliance Automatic Ltg. Co., 1925 Meade, Racine, Wis.
Research Mfg. Laboratory, 1269 Cochran Ave., Los Angeles.
Robbins & Myers Co., Springfield, O.
Ross Safety Switch Corp., 1 E. 42nd, New York, N. Y.
Sauter. See Cramer & Co.
States Co., Hartford, Conn.
Thompson Clock Co., H. C., Bristol, Conn.
York Clocks, Inc., 12 E. 41st, New York, N. Y.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

TACHOMETERS

Speed Indicators, Speedometers, Revolution Counters.

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Durant Mfg. Co., 655 Buffum, Milwaukee, Wis.
Electric Tachometer Corp., Spring Garden & Broad St., Philadelphia, Pa.
Holtzer-Cabot Elec. Co., Boston, Mass.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.

Productimeter. See Durant Mfg. Co.
Standeo. See Sticht & Co.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Veeder Mfg. Co., 14 Sargeant, Hartford, Conn.
Weston Elecl. Instrument Co., 582 Frelinghuysen Ave., Newark, N. J.

TAGS, Cable; Pole and Battery

American Radio Hardware Co., 135 Grand, New York, N. Y. (Battery Lead Tags.)
Benedict Mfg. Co., East Syracuse, N. Y.
Brooklin Underground Elec'l Mfg. Co., Glenside, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Grammes & Sons, Inc., L. F., Allentown, Pa.
International Tag Co., 319 N. N. Whipple, Chicago, Ill.
Premax Products, Inc., Niagara Falls, N. Y.
Viking Tool & Machine Co., 745 65th, Brooklyn, N. Y.
Waterbury Button Co., Waterbury, Conn.

TAGS, Shipping

Campbell Paper Box Co., South Bend, Ind.
International Tag Co., 319 W. Whipple, Chicago, Ill.

TANK SWITCHES. See Switches, Tank.
TANKS, TINNING. See Wire Manufacturing Machines.

TAPE, Asbestos

American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
General Asbestos & Rubber Co., Charleston, S. C.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Niagrite. See Johns-Manville, Inc.
Shield Brand. See Mitchell-Rand Mfg. Co.

TAPE, Cotton, Linen, Silk; Tape, Sleeving, Webbing.

Anchor Webbing Co., Nye, Pawtucket, R. I. (Cotton, Silk.)
Awebco. See Ancher Webbing Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beledentape. See Belden Mfg. Co.
Eagle. See Sidebotham, Inc., John.
General Electric Co., Schenectady, N. Y.
Glitmer Co., L. H. (Tacony), Philadelphia, Pa.
Hope Webbing Co., 1005 Main, Providence, R. I.
Krout & Fite Mfg. Co., Allegheny Ave. & Emerald, Philadelphia, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sidebotham, Inc., John, 4317 Griscom, Philadelphia, Pa.
Smith Belting Co. (Germantown), Philadelphia, Pa.
Superfine. See Windsor Webbing Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Windsor Webbing Co., Pawtucket, R. I.
Worcester Braiding Co., 34 Southbridge, Worcester, Mass.

TAPE, Mica

Chicago Mica Co., Valparaiso, Ind.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Rubber and Friction

Ackerman. See Ackurate Rubber Co.
Ackurate Rubber Co., 25 Beaver St., New York, N. Y.
Adamson & Co., Joseph, Columbia and Germantown Aves., Philadelphia, Pa.
Adhere. See Westinghouse Elec. & Mfg. Co.
Alpha. See Johns-Manville, Inc.
Amazon. See Graybar Elec. Co.
Appleton Rubber Co., Franklin, Mass.
Black Diamond. See Dunton Co., M. W.
Boston Woven Hose & Rubber Co., P. O. Box 5077, Boston, Mass.
Brooklyn. See Johns-Manville, Inc.
Bull-Dog. See Boston Woven Hose & Rubber Co.
Canfield Rubber Co., Bridgeport, Conn.
Canton. See Plymouth Rubber Co.
Clifton. See Clifton Mfg. Co.
Clifton Mfg. Co., 65 Brookside Ave., Boston 30, Mass.
Competition. See New York Insulated Wire Co.
Double-Wear. See Dryden Rubber Co.
Dryden Rubber Co., 1014 S. Kildare Ave., Chicago, Ill.
Duncee, A. & B. See Okonite Co.
Dunton Co., M. W., 670 Eddy St., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Elkhart Rubber Wks., Elkhart, Ind.
Firestone Tire & Rubber Co., Akron, O.
General Elec. Co., Merchandise Dept., Bridgeport, Conn.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y.
Grimshaw. See New York Insulated Wire Co.
Griptite. See Canfield Rubber Co.
Holdfast Rubber Co., Atlanta, Ga.
Holdtite. See United States Rubber Co.
Hydro-Proof. See Elkhart Rubber Wks.
Imperial Rubber Co., 220 Broadway, New York N. Y.
Impervo. See Canfield Rubber Co.
Irco. See Imperial Rubber Co.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Jomanco. See Johns-Manville, Inc.
Kerite Ins. Wire & Cable Co., 30 Church, New York, N. Y.
Magnet. See Boston Woven Hose & Rubber Co.
Manson. See Okonite Co.
New York Insulated Wire Co., 114 Liberty, New York, N. Y.
Okonite Co., Passaic, N. J.
O. K. See Appleton Rubber Co.
P. & B. See Ruberoid Co.
Paratex. See Appleton Rubber Co.
Paruco. See Passaic Rubber Co.
Passaic Rubber Co., Clifton, N. J.
Plymouth Rubber Co., 1400 Revere, Canton, Mass.
Red-X. St. Louis Rubber Cement Co.
Relio. See United States Rubber Co.
Ruberoid Co., 95 Madison Ave., New York, N. Y.
S. I. See Superior Insulating Tape Co
Service. See Boston Woven Hose & Rubber Co.
Slipknot. See Plymouth Rubber Co.
St. Louis Rubber Cement Co., 3952 West Pine, St. Louis.
Star. See Sullivan & Sons Mfg. Co., J.
Sticks. See Graybar Elec. Co.
Stixwell. See Clifton Mfg. Co.
Sullivan & Sons Mfg. Co., J., 2224 N. 9th, Philadelphia, Pa.
Superior Insulating Tape Co., 3044 Lambdin Ave., St. Louis.
2-Plex. See Holdfast Rubber Co.
U. S. See United States Rubber Co.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago.

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Our No. 1800 metal for temperatures up to 450° F.
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Victor. See Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Varnished Fabric

Acme Wire Co., New Haven, Conn.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
General Electric Co., E. M. 12, Merchandise Dept., Bridgeport, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New Jersey Wood Finishing Co., Woodbridge, N. J.
Radiotape. See Respro, Inc.
Respro, Inc., Wellington Ave. (Auburn), Providence, R. I.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sico. See Standard Insulator Co.
Standard Insulation Co., East Rutherford, N. J.
Voltape. See Respro, Inc.

TAPING MACHINES, Coil

Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Griswold Machine Co., George, New Haven, Conn
Ridlon Company, Frank, Boston, Mass.
Segur. See Electric Service Supplies Co.

TAPING MACHINES, Wire

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Wire Machinery Corp. of Am., New Haven, Conn.

TAPS. See Stocks, Dies and Reamers.

TENSION DEVICES, Coil Wire. See Racks, Wire Reel.

TENSION MACHINES, Band Wire

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.

TERMINALS AND CONNECTORS

Low Tension, Secondary Terminals and Connectors.

All-in-One. See Ohio Parts Co.
Barcy-Nicholson Co., 2801 Fort, W., Detroit, Mich.
Bassett Metal Goods Co., Derby, Conn. (General Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Burton-Rogers Co., Boston, Mass.
Cabelug. See Jones, Howard B.
Clark Metal Products, 490 Hancock Ave., Bridgeport.
Dixie Supply Co., 91 7th Ave., New York.
Double Grip. See Pons, Eugene
Eagle Elec. Mfg. Co. Dept. ER4, 59 Hall, Brooklyn, N. Y.
Electron. See Bassett Metal Goods Co.
Fahnestock Elec. Co., East Ave. and 8th, Long Island City, N. Y.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Ideal Clamp Mfg. Co., 198 Bradford, Brooklyn, N. Y.
Jones, Howard B., 2226 Wabansia, Chicago, Ill.
K. E. M. See Kulier Elec. Mfg. Co.
Kulier Elec. Mfg. Co., 575 Pierce Ave., Long Island City.
Morse Co., Frank W., Boston, Mass.
Nu-Way Snap. See Hatheway Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati, O.
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa.
Patton-MacGuyer Co., Providence, R. I.
Pons, Eugene, 927 Campbell Ave., Schenectady, N. Y.
Peterson Co., 7 Beverly, Providence, R. I.
Rajah Co., Bloomfield, N. J.
Salem Elec'l Supply Co., Salem, Mass.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Shure. See Burton-Rogers Co.
Tinkerbox. See Weber Elec. Wks.
Waterbury, Button Co., Waterbury, Conn.
Weber Elec. Wks., Brooklyn Sta., Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York.

TEST BENCHES, Armature

Allen Electric & Equipment Co., Kalamazoo, Michigan.
Burton & Rogers Co., Boston, Mass.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Hobart Bros. Co., Troy, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Pence & Son, H. O., San Luis Obispo, Cal.
Weidenhoff, Joseph, 4332 W. Roosevelt Road, Chicago, Ill.

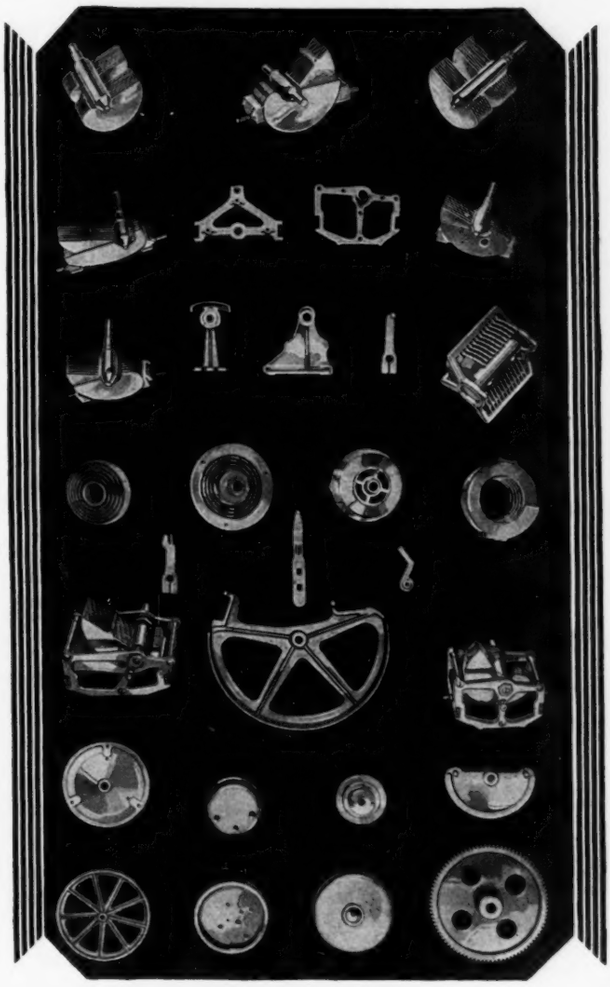
TESTING INSTRUMENTS. See Instruments.

TESTERS, Coil

(Includes Armature Growlers, trouble shooters, and other portable testing devices). See also Instruments

Ace. See Weidenhoff, Joseph.
Allen-Bradley Company, 493 Clinton, Milwaukee, Wis.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Ankenbrandt, J. J., 2140 Wakeman, Toledo, Ohio.
Armeter. See Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Bartlett Electric Products Co., Goshen, Ind. (Storage Battery).
Batt-O-Meter. See Indiana Mfg. & Elec. Co., also Case Elec.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Case Elec. Co., Marion, Ind.
Century Electrical Co., 102 Randall Ave., Syracuse, N. Y.
Chapman Elec'l Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Columbia. See Weidenhoff, Joseph.
Comparometer Co., New Ulm, Minn.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Economy. See Weidenhoff, Joseph.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Electrotest. See Comparometer Company.
Elmco. See Electric Machine Corp.
Ev-Ri-Test. See Weidenhoff, Joseph.
Forest Electric Co., 272 New, Newark, N. J.
Ga-Jit. See General Instrument Corp.
General Instrument Corp., 477 Broadway, New York, N. Y.
Hobart Bros. Co., Troy, Ohio.
Ideal. See Ankenbrandt, J. J.
Indiana Mfg. & Electric Co., Marion, Indiana.
Kietzman Electrical Mfg. Co., 234 N. Central, Gilman, Ill.
Leich Electric Co., Genoa, Ill.
Lundin Electric Machine Co., 10 Thacher, Boston, Mass.
Mallory Electric Co., Factories Bldg., Toledo, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Meco. See Metropolitan Mfg. & Elec. Co.
Metropolitan Mfg. & Elec. Co., 1163 Sedgwick, Chicago, Ill.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Paneltest. See Forest Electric Co.
Portometer. See Forest Electric Co.
Portostat. See Forest Electric Co.
Presto. See Metal Specialties Mfg. Co.
Reliable Parts Mfg. Co., Wellington, Ohio.
Rex Batrystat. See Bartlett Products Co.
Scout. See Leich Electric Company.
Serrwell Sales Corp., 1749 N. Winchester Ave., Chicago, Ill.
Test-All. See Colpin Corp.

BARNHART Die Castings in Chicago



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Testers, Coil—Continued
Test-O-Meter. See Weidenhoff, Joseph.
Test-Rite. See Colpin Corp.
Victory. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

TESTING LABORATORIES

Elec'l Testing Laboratories, 80th St. and East End Ave., New York, N. Y.
National Elec'l Inst. Co., 162 Sidney, Cambridge, Mass.
New York Testing Laboratories, 80 Washington, New York.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Stupakoff Laboratories, 6617 Hamilton Ave., Pittsburgh, Pa.
THERMO JUNCTIONS. See Instruments, Laboratory Standard.

THERMOSTATIC METAL

Chace Valve Co., W. M., 1600 Beard Ave., Detroit, Mich.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I.
Imroved Seamless Wire Co., 775 Eddy, Providence, R. I.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Wilco. See H. A. Wilson Co.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

THERMOSTATS

Absolute Con-Tac-Tor Corp., Elkhart, Ind.
American Thermostat Co., 226 Jelliff Ave., Newark, N. J.
Automatic Appliance Co., Jackson, Mich.
Bak-Rite. See Electric Appliance Mfg. Co.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia, Pa.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cobb Elec. Appliance Co., 2 Lanesville Ave., Boston, Mass.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cramblet Engineering Corp., 286 Milwaukee, Milwaukee, Wis.
Diamond H. See Hart Mfg. Co.
Electric Automatic Appliance Co., Denver, Colo.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electric Maid. See Hankscraft Co.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Globe Mfg. Co., Battle Creek, Mich.
Hankscraft Co., 615 E. Washington, Madison, Wis.
Hart Mfg. Co., Hartford, Conn.
Hi-Lo. See Boston Machine Wks. Co.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Interstate Products Corp., 29 Commercial, Newark, N. J.
King. See Electric Heat Control Co.
Leachwood Co., Janesville, Wis.
Manhattan Elec'l Supply Co., New York, N. Y.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Moeller, A. E., 291 Sumpter, Brooklyn, N. Y.
Midget. See Coffin Mfg. Co., B. F.
National Steel Construction Co., 425 Fountenac, Seattle, Wash.
Pyratherm. See Federal Gauge Co.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Standard Thermometer Co., 65 Shirley, Boston 19, Mass.
Tagliabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Teeple Co., L. R., 540 E. 9th, Portland, Ore.
Thermolectric. See Bishop & Babcock Sales Co.
Thermomap. See Spencer Thermostat Co.
Trent Co., Harold E., 439 N. 12th, Philadelphia, Pa.
Visaflame. See Mercoid Corp.

TIGHTENERS, Commutator

Elmes Engineering Works, Chas. F., 222 N. Morgan, Chicago, Ill.
TIME SWITCHES. See Switches, Time.
TINNING TANKS, WIRE. See Wire Manufacturing Machines.
TINSEL. See Wire, Insulated.

TIPS, Cord

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldentube. See Belden Mfg. Co.
Duro. See McEvoy, C. H.
McEvoy, C. H., 430 Broadway, Lowell, Mass.
National Acme Mfg. Co., 7500 Stanton Ave., Cleveland, O.
Norden & Co., S. 180 S. Water, Providence, R. I.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.
TOOLS, Commutator Slotting. See Slotting Machines & Tools, Commutator.

TOOLS, Commutator Truing

Acme. See Green Equipment Corp.
Allen Elec. & Equipment Co., N. Pitcher St., Kalamazoo, Mich.
Binghamton Flexible Shaft Co., Binghamton, N. Y.
Central Mfg. Co., Fairfield, Ia.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Imperial. See Martindale Elec. Co.
Jordan Bros., 74 Beekman, New York, N. Y.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, Ohio.

TOOLS, Storage Battery

Battery Eulpment & Supply Co., 7530 Greenwood Ave., Chicago, Ill. Burning Racks, Battery Trucks, Plate Pressers, Mallets, Lead Burners and Strainers.
Battery Parts Co., Inc., Wilkinsburg, Pa. (Leads.)
Battery Tools Co., 29 Willow, Montclair, N. J.
Besco. See Battery Equipment & Supply Co.
Bobbett Elec. Mfg. Co., 811 E. 43rd St., Chicago, Ill. (Knife Heaters.)
Canedy-Otto Mfg. Co., 1816 McGee, Chicago Heights, Ill. (Floor Vises.)
General Elec. Co., Schenectady, N. Y. (Lead Burning Outfits.)
Heet-A-Knife. See Op-al. Elec. & Mfg. Co.
Ibsco. See Illinois Battery Steamer Co.
Illinois Battery Steamer Co., Peoria, Ill.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati. (Terminals.)
Op-al Elec. & Mfg. Co., 1057 E. 30th St., Indianapolis, Ind. (Knife Heaters.)
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa. (Pillar Post Sleeves, Tongs, Reamers, Strap Punches, Terminal Pullers, Steamers, Racks or Stands, Terminal Post Shapers, Battery Analyzer, Post Sealing Machine, Plate Burning Press, Press and Stands.)
Pyratip. See General Elec. Co.
Reliable Parts Mfg. Co., Wellington, O. (Steamer and Still, Filler, Separator Cutter, Clips, Carrier, Post Cutter, Terminal and Cell Puller.)
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Dreadnaught. See Wall Mfg. Supply Co.
Klein & Sons, Mathias, Chicago, Ill.
Lasher-Peerblow Co., 237 Harrison Ave., Boston, Mass.
McGill Mfg. Co., Valparaiso, Ind.
Peerless. See Lasher-Peerblow Co.
Staysalite. See Klein & Sons, Mathias.
TORPEDO Cord. See Twine.
TORSION BALANCES. See Instruments, Laboratory Standard
TRANSFORMERS
Radio. See Radio Circuit Components.
Gas Tube Sign. See Transformers, Oil Burner.
Oil Burner Ignition. See Transformers, Oil Burner.

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Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Dongan Elec. Mfg. Co., 2545 Franklin, Detroit, Mich.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
Manhattan Elecl. Supply Co., 17 Park Pl., New York, N. Y.
Sorgel Electric Co., 89 W. Water, Milwaukee, Wis.
Standard Transformer Co., Warren, O.
Thordarson Elec. Mfg. Co., Huron & Kingsbury Sts., Chicago, Ill.
Uptigraff Mfg. Co., R. E., First National Bank Bldg., Pittsburgh, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Webster Electric Co., Racine, Wis.
TRANSMISSION DRIVES. See Chain, Transmission.

TRANSMITTERS, Power

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Segur. See Electric Service Supplies Co.
TROUBLE FINDERS. See Instruments, Portable and Switchboard; also Testers, Coil.
TRUCKS. Armature. See Lifts, Armature.

TRUCKS, Factory Steel

Angle Steel Stool Co., Plainwell, Mich.
TRUING Devices, Commutator. See Tools, Commutator.
TUBE (Tubes) (Tubing) Adapters. See Radio Receiver Parts.
Brass. See Tubing, Brass.
Condenser. See Tubing, Brass and Copper.
Copper. See Tubing, Brass.
Cutters. See Stocks, Dies, etc.
Fibre. See Fibre.
Fibre Candle. See Candles.
Mica. See Mica.
Paper. See Tubes, Paper.
Platinum. See Platinum.
Pyrometer. See Cores, Resistance.
Refractory. See Cores, Resistance.
Radio. See Radio Vacuum Tubes.
Varnished Fabric. See Tubing, Varnished Fabric.

TUBES, Paper; Cores; Sleeves, Bushings

Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Climax Tube Co., Myrtle, Conn.
Klimaxcore. See Climax Tube Co.
McCausland, J. E., 86 Valley, Providence, R. I.
Pairpoint Corp., New Bedford, Mass.
Reliable Elec. Co., 3145 Carroll Ave., Chicago, Ill.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.
Stone Paper Tube Co., 38 O. N. B., Washington, D. C.
Textile Tube Co., Fall River, Mass. (Paper Sleeves.)

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
Bull Dog. See National Elec. Products Corp.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., T. E., 54 Lafayette, New York
Cook, Dunbar Smith Co., 85 Sprague, Providence, R. I.
French Mfg. Co., 128 Robbins, Waterbury, Conn.
Mueller Brass Co., Port Huron, Mich.
National Copper & Smelting Co., 1395 Coltman Rd., Cleveland, O.
National Electric Products Corp., Pittsburgh, Pa.
Randolph Clowes Co., Waterbury, Conn.
Relleum. See Mueller Brass Co.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Rome Brass & Copper Co., Rome, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Rome Turney Radiator Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa.
Summerill Tubing Co., Bridgeport, Pa.
Torrington Mfg. Co., Torrington, Conn.
United Wire & Supply Co., 1497 Elmwood Ave., Providence.
Wells Co., A. H., Watertown Ave., Waterbury, Conn.
Wolverine Tube Co., 1435 Central Ave., Detroit, Mich.

TUBING, Flexible Metallic

Almond Mfg. Co., T. R., Ashburnham, Mass.
American Metal Moulding Co., 146 Coit St., Irvington, N. J.
Auto-Brassflex. See National Metal Molding Co.
Auto-Steelflex. See National Metal Molding Co.
Breeze Metal Hose & Mfg. Co., 24 S. 6th, Newark, N. J.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Leachwood Co., Janesville, Wis.
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa.
Ridlex. See United Metal Hose Co.
Sleeper & Hartley, Inc., Worcester, Mass.
Titeflex Metal Hose Co., Newark, N. J.
Triangle Conduit Co., Dry Harbor Rd. and Cooper Ave., Brooklyn, N. Y.
United Metal Hose Co., 724 Garrison Ave., New York, N. Y.
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.

TUBING, Rubber

Rubber Tubing for Insulating Wire in Instruments and Telegraph Signal Lines.
Faultless Rubber Co., Ashland, O.
Forest City Rubber Co., 1276 Ontario, Cleveland, O.
Goodrich Rubber Co., B. F., Akron, O.
Tyler Rubber Co., Andover, Mass.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y

TUBING, Varnished Fabric

Insulating Tubing—Spaghetti.
Acme Wire Co., New Haven, Conn.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., Wm., 268 Fourth Ave., New York, N. Y.
Empire. See Mica Insulator Co.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn
Goodrich Rubber Co., B. F., Akron, O.
Insulated Duct & Cable Co., Stokes, Trenton, N. J.

Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
Irvington Varnish & Insulator Co., Irvington, N. J.
Lee Tire & Rubber Co., Conshohocken, Pa.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky. (Insulated Waxed Cotton.)
Turbo. See Brand & Co.
Varflex Corp., Rome, N. Y.

TURNED-UP BOXES AND CABINETS. See Cabinets, Sheet Steel.

TWINE, Armature Winding; Torpedo Cord

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Wirne & Son, Frank W., 42 N. Front, Philadelphia, Pa.

UNDERCUTTERS, Mica. See Slotting Machines & Tools, Commutator.
UNITS, Refrigerator Condenser. See Condenser Units, Refrigerator.

UNITS, Rods and Grids, Resistance

Acme Elec. Heating Co., Dept. R, 1217 Washington, Boston.
Allen-Bradley Co., 493 Clinton, Milliwaukee, Wis.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa.
Bradleyunit. See Allen Bradley Co.
Buffalo Products Co., Broome & Lafayette Sts., New York.
Burger, J. P., 1813 Columbus Rd., Cleveland, O.
Calrod. See Edison Elec. Appliance Co.
Carter Radio Co., 2422 Prospect Ave., Chicago, Ill.
Chromalax. See Edwin L. Wiegand Co.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Crown Coloring & Chemical Co., 33 W. 17th, New York.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dalton Elec. Heating Co., 287 Bridge St., Salem, Mass.
Dalton-Marsh Co., 88 Holten, Danvers, Mass.
Daric Co., 35 E. 21st, New York, N. Y.
Di-El-Ite. See Wirt Co.
Dixon Crucible Co., Jos., Jersey City, N. J.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Edgewound. See Monitor Controller Co.
Edison Electric Appliance Co., 5600 W. Taylor, Chicago, Ill.
Elec. Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electro Thermal-Unit Co., 44 N. Fourth, Philadelphia, Pa.
Elemite. See Louthan Mfg. Co.
Fits-All. See Eagle Elec. Mfg. Co.
Fitz-All. See Rodale Mfg. Co.
Fitz-Rite. See Rodale Mfg. Co.
Fix-All. See Witlow Elec. Mfg. Co.
F & M. See Hiram Marks Elec. Co.
General Electric Co., Schenectady, N. Y.
Globar Corp., Niagara Falls, N. Y.
Glo-Well. See Eagle Elec. Mfg. Co.
Gold Seal Elecl. Co., 250 Park Ave., New York, N. Y.
Hance-Parker Mfg. Co., Meriden, Conn.
Hankscraft Co., 615 E. Washington, Madison, Wis. (Oven Heater Unit.)
Hexwound. See Monitor Controller Co.
Industrial Heater Co., 300 Canal, New York, N. Y.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa. (Radio Resistance.)
Krischer's Mfg. Co., 255 Calyer, Brooklyn.
Louthan Mfg. Co., East Liverpool, O.
Marks, Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
Monitor Edgewound. See Clark Controller Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
National Elec'l Supply Co., 1328 New York Ave., Washington, D. C.
Nelco. See Nelson Electric Co.
Nelson Electric Co., Plant City, Fla.
Northern Electric Co., 2832 N. Western Ave., Chicago, Ill.
Ogden Mfg. Co., 3947 Armitage Ave., Chicago, Ill.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ohm-Spun. See States Co.
Op-al Elec. & Mfg. Co., 1057 W. 30th, Indianapolis, Ind.
Parker & Co., J. C., 407 Bulletin Bldg., Philadelphia, Pa.
Poloron Elec. Mfg. Co., 20 Bond, New York, N. Y.
Presto Products Co., 64 University Place, New York, N. Y.
Prometheus Elec. Corp., 358 W. 13th, New York, N. Y.
Pyrox. See Westinghouse Elec. & Mfg. Co.
Reben Elec. Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Renuall. See Ogden Mfg. Co.
Repairall. See Waage Elec. Co.
Replaceall. See Waage Elec. Co.
Resistance Laboratories, Inc., 20 W. 22nd, New York, N. Y.
Ribohm. See Ward Leonard Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Security Elec. Mfg. Co., 2633 Canton St., Chicago, Ill.
Sepco. See Automatic Electric Heater Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Smoothwound. See Monitor Controller Co.
Snoco. See Snow & Co.
Snow & Co., E. W., Rochester, N. Y.
Super. See Northern Elec. Co.
United Metal Art Mfg. Co., 293 Wyckoff Ave., Brooklyn, N.Y.
Vitrohm. See Ward Leonard Elec. Co.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Warren Elec. Appliance Co., Warren, Pa.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegand Co., Edwin L., 422 1st Ave., Pittsburgh, Pa.
Wirt Co., 5221 Greene, Philadelphia, Pa.
VACUUM CLEANER BAGS. See Bags, Vacuum Cleaner.
VACUUM DRYING & IMPREGNATING OVENS. See Ovens, Industrial.
VACUUM PUMPS. See Pumps, Vacuum.

VALVES, Electrically Operated

Absolute Con-tac-tor Corp., Elkhart, Ind.
Asco. See Automatic Switch Co.
Automatic Switch Co., 154 Grand, New York.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., ft. of Tolman, Boston, Mass. (Water.)
Crane Co., S. Michigan Ave., Chicago, Ill.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dual Automatic Valve Co., Rock Island, Ill.
Electric-Valve Mfg. Co., 68 Murray, New York, N. Y.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gas-Gard Co., 375 Main St., E., Rochester, N. Y. (Gas.)
General Electric Co., Schenectady, N. Y.
Golden-Anderson Valve Specialty Co., 1335 Fulton Bldg., Pittsburgh, Pa.
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Beedle Equipment Co., 1309 Union Trust Bldg., Cincinnati, Ohio
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Northside Elec. Co., 4227 Spring Grove Ave., Cincinnati, O.
Protect-U. See Zisch Engineering Corp.
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Teeple Co., L. R., 540 E. Ninth, Portland, Ore. (Gas.)
Victor. See Lunkenheimer Co.
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VARNISH. See Paint, Varnish, Lacquer.
VARNISHED TAPE. See Tape, Varnished Fabric.
VARNISHED TUBING. See Tubing, Varnished Fabric.
VOLT BOXES. See Instruments, Laboratory Standard.
VOLTMETERS. See Instruments.
VULCANITE. See Rubber, Hard.

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WASHERS, FIBRE. See Fibre.

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Keystone. See Positive Lock Washer Co.
National Lock Washer Co., Newark, N. J.
Positive Lock Washer Co., Ave. A & Miller, Newark, N. J.
Shakeproof Lockwasher Co., 2513 N. Keeler Ave., Chicago.
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Hubbard Spring Co., M. D., Pontiac, Mich.
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New England Screw Co., Dept. A., 44 Farnsworth, Boston.
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WATTMETERS. See Instruments.

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Junction Box, Potheads, Battery Tops, Bolt Head Holes.
Wax and Compound.....See S
Saturating and Finishing, Braided Wire, Impregnating Fabric and Paper.
Chatterton's Compound .....See C

Ajax. See Sherwin-Williams Co.
Asphalt Products Co., 6531 S. State, Chicago.. . . S . .
Bishop Wire & Cable Corp., 420 E. 23th, New York, N. Y. C
Biwax Corp., 208 S. La Salle, Chicago, Ill. ..... W . . . .
Black Nego. See Williams Co., F. M.
Bulls-Eye. See Zinsser & Co.
Candy & Co., 35th and Maplewood Ave., Chicago W S . .
Clifton Mfg. Co., 65 Brookside Ave., Boston.... . . . C
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J..... W S . .
Dolph Co., John C., 168 Emmet, Newark, N. J. W . . . .
Ever-Protect. See National Cable Compound Co.
Flake White. See Williams Co., F. M.
General Electric Co., E. R. 12, Merchandise Dept., Bridgeport, Conn..... W . . . .
Glenn Chemical Co., Murray Road & Big 4 R. R. St. Bernard, Cincinnati, O..... W S . .
Goldo Brown. See Williams Co., F. M.
Great Lakes Thread & Yarn Co., 5133 Wesson Ave., Detroit, Mich..... W . . .
Herculate. See Tar Products Corp.
Imco. See Great Lakes Thread & Yarn Co.
India Red Seal. See Williams Co., F. M.
Insulatine Co., 1 Broadway, New York..... W . . . .
Leverite. See Mitchell-Rand Mfg. Co.
Lime Seal. See Mitchell-Rand Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind..... . . . C
Mineralac Elec. Co., 1045 Washington Blvd., Chicago, Ill. ..... W . . .
Mitchell-Rand Mfg. Co., 19 Vesey, New York.... W S C
Mule-Hide. See Lehon Co.
National Cable Compound Co., Mitchell, Ind.... W . . . .
Nu-Blac. See Star Porcelain Co.
Ohmiac Paint & Refining Co., 140 S. Dearborn, Chicago, Ill. ..... W . . . .
Par Flexo. See Williams Co., F. M.
Rubberseal. See Mitchell-Rand Mfg. Co.
Rub-Flexo. See Williams Co., F. M.
Seidner & Enequist, Inc., 86 Hausman, Brooklyn, N. Y. ..... W . . .
Sherwin-Williams Co., Cleveland, O. ..... W . . C
Standard Varnish Wks., 433 4th Av., New York.. W . . . .
Standard Wax & Import Co., 110 E. 42nd, New York, N. Y. ..... W S . .
Star Porcelain Co., Trenton, N. J..... W . . C
Tacrite. See Seidner & Enequist, Inc.
Tar Products Corp., Providence, R. I.
Trotter & Co., E. T., 576 Johnson Ave., Brooklyn, N. Y. ..... W S . .
Waverly Oil Wks., 54th and A. V. R. R., Pittsburgh, Pa. ..... S . .
Williams Co., F. M., 1238 Prospect Ave., Brooklyn, N. Y.
Zinsser & Co., 48 Vesey, New York, N. Y..... W . . .

WELDS, Lamp Lead-in. See Filaments, Incandescent

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Agnew Electric Welder Co., Milford, Mich.
Allan Mfg. & Welding Corp., 726 Washington, Buffalo.
Alternarc. See Electric Arc Cutting & Welding Co.
American Elec. Fusion Corp., 2610 Diversey Ave., Chicago.
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Atlas. See Railway Track Work Co.
Automatic Trolley Guard Co., 65 Carroll, Buffalo, N. Y.
Burke Electric Co., Erie, Pa.
Cushing Mfg. Co., 5617 Pacific Blvd., Los Angeles, Cal.
Dwyer Machine Co., Lynn, Mass.
Eisler Engineering Co., 756 S. 13th, Newark, N. J.
Electric Arc Cutting & Welding Co., 156 Jelliff Ave., Newark, N. J.
Electric Autolite Co., Toledo, O.
Electric Ry. Improvement Co., 2070 E. 61st, Cleveland, O
Electric Welding Co. of America, 744 Court, Brooklyn, N. Y.
Electric Welding Machine Co., 1530 Larned, E., Detroit.
Erico. See Electric Railway Improvement.
Farwest Electric Welder Co., 1107 Northlake Ave., Seattle.
Federal Machine & Welder Co., Dana Ave., Warren, O.
Fleet-Weld. See Lincoln Elec. Co.
Fusion Welding Corp., 103rd St. & Torrence Ave., Chicago.
Fuzon. See Fusion Welding Corp.
General Electric Co., Schenectady, N. Y.
General Engrg. & Supply Co., 160 5th Ave., New York, N. Y.
Gesco. See General Engineering.
Gibb Welding Machines Co., Bay City, Mich.
Hansen. See Northwestern Mfg. Co.

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Compounds
Paints and Varnishes
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41 years in the business. Write for samples of our latest finishing and saturating wax.
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432 Danforth Ave., Jersey City, N. J.

Indianapolis Switch & Frog Co., Springfield, O.
Lincoln Electric Co., Coit Rd. and Kirby Ave., Cleveland.
McAdams Co., J. C., 912 Second Ave., Long Island City.
Northwestern Mfg. Co., 480 Clinton, Milwaukee, Wis.
Plastic Arc. See Wilson Welder & Metal Co.
Pyrotip. See General Elec. Co.
Railway Track Work Co., 3132 E. Thompson, Philadelphia.
Rail Welding & Bonding Co., 1615 Collamer Ave., Cleveland.
Ryerson & Son, Jos. T., 2558 W. 16th, Chicago, Ill.
Seneca Electric Welder Corp., 5057 Woodward, Detroit, Mich.
Siemund Wenzel Electric Welding Co., 79 Hancock, Long Island City, N. Y.
Swift Elec. Welder Co., 2567 W. Grand Blvd., Detroit.
Taylor-Winfield Corp., 12 Atlantic, Warren, O.
Thompson Electric Welding Co., Lynn, Mass.
Toledo. See Thompson.
U. S. L. Battery Corp., Niagara Falls, N. Y.
Welding Materials Co., 114 Liberty, New York, N. Y.
Weldrite. See Electric Welding Machine Co.
Wemco. See Welding Materials Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metal Co., Hoboken factory, Terminal Bldg., Hoboken, N. J.
Winfield Elec. Welding Machine Co., 12 Atlantic, Warren, O.
Zeus. See Gibb Welding Machine Co.

WHEATSTONE BRIDGES. See Instruments, Laboratory Standard.

WINDERS

Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Coil. See Winding Machines, Armature & Field Coil.
Electromagnet. See Winding Machines, Induction Coil.
Filament. See Machines, Lamp Making.
Induction Coil. See Winding Machines, Induction Coil.
Loop. See Winding Machines, Armature & Field Coil.
Winding Forms. See Forms, Coil Winding.

WINDING FORMS. See Forms, Coil Winding.

WINDING MACHINES, Armature and Field Coil

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Fredericks Co., H. M., Lock Haven, Pa.
Handy. See Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Hunsdorf, Wm., 2056 E. Fourth, Cleveland, O.
Liberty Starter Co., W. Fort & Minnie Sts., Detroit, Mich.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Lyknu. See Fredericks Co.
Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio.
Mutual Foundry & Machine Co., Atlanta, Ga.
Oman, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Segur. See Electric Service Supplies Co.
Superior. See Armature Coil Equipment Co.

WINDING MACHINES, Induction Coil

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.
Easton Coil Co., Easton, Pa.
Electrical Products Mfg. Co., Providence, R. I.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Leesona. See Universal Winding Co.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Morris Register Co., 29th & Broadway, Council Bluffs, Iowa.
Radio Production Machinery Co., 312 Centre, New York.
Bidlon Company, Frank, 253 A St., Boston, Mass.
Universal Winding Co., Boston, Mass.
Weber & Scher Mfg. Co., 263 Sussex Ave., Newark, N. J.
Weehawken Elec. & Mfg. Co., 543 Gregory Ave., Weehawken, N. J.

WINDINGS. See Coils, Finished.

WINDOW SHADES, Factory

Athey Co., 6162 West 65th St., Chicago, Ill.

WIRE (Cable) (Cord), Aluminum. See Aluminum.
Copper Clad. See Wire, Copper Clad.
Forms. See Forms, Wire.
Frames. See Forms, Wire.
Fuse. See Fuses and Fuse Wire.
Molybdenum. See Molybdenum.
Phosphor Bronze. See Phosphor Bronze.
Platinum. See Platinum.
Radio Bus. See Wire, Bare.
Scrapers. See Scrapers, Wire.
Strippers. See Scrapers, Wire; Tungsten. See Filament, Incandescent Lamp.

WIRE, Bare

Armature Banding	See S
Copper Wire	See C
Iron Wire	See S
Phosphor Bronze	See R
Radio Bus Wire	See C
Resistance Wire	See R
Steel Wire	See S

Advance. See Driver Harris Wire Co.
Alloy Metal Wire Co., Moore, Pa..... C R . .
American Brass Co., 25 Broadway, New York.
American Copper Products Corp., 233 Broadway, New York, N. Y. ..... C R . .
American Electrical Works (Phillipsdale), Providence, R. I. ..... C . . .
American Insulated Wire & Cable Co., Div. of General Cable Corp., 954 W. 21st, Chicago.... C . . S
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... C . . S
Anaconda. See American Brass Co.
Anvilite Elec. Co., Fort Wayne, Ind..... C . . .
Ballast. See Gilby Wire Co.
Baltimore Copper Mills (Div. of General Cable Corp.), Baltimore, Md..... C . . .
Bassett Metal Goods Co., Derby, Conn. (General Sales Agent, Hatheway & Co., 16 Hudson, New York, N. Y. ..... C . . .
Belden Mfg. Co., 2310B S. Western Ave., Chicago C . . S
Beldenite. See Belden Mfg. Co.
Bradford, Kyle & Co., Plymouth, Mass..... . . B . .
Braidite. See Cornish Wire Co.
Brenvar. See American Insulated Wire & Cable Co.
Bridgeport Brass Co., Bridgeport, Conn..... C . . .
Calido. See Driver Harris Wire Co.
Chromel. See Hoskins Mfg. Co.
Chromic. See Murray-Harris Wire Co.
Climax. See Driver Harris Wire Co.
Comet. See Driver Harris Wire Co.
Comin. See Gilby Wire Co.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I. C . . .
Copel. See Hoskins Mfg. Co.
Copperweld Steel Co., Glassport, Pa..... C . . S
Cornish Wire Co., 30 Church, New York, N. Y.. C . . .
Corwico. See Cornish Wire Co.
Crapo. See Indiana Steel & Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J.. C . . .
Cupron. See Gilby Wire Co.
Darow Mfg. Co., 97 Greene, New York, N. Y... C . . .
Detroit Insulated Wire Co., Detroit, Mich..... C . . .
1885. See Chicago Insulated Wire & Mfg. Co.
Driver Harris Wire Co., Harrison, N. J..... . . B . .
Electron. See Bassett Metal Goods Co.
Excellcier. See Branford Elec. Co.
Fullman Mfg. Co., 1209 Jefferson, Latrobe, Pa.. . . . . .
Gilby Wire Co., Riverside Ave., Newark, N. J.... . . B
Goldmark Co., James, 83 Warren, New York.. C . . .
Hope Webbing Co., Providence, R. I. (Braided Wire Tape) ..... C . . .
Hoskins Mfg. Co., Detroit, Mich..... . . B . .
Hudson Wire Co., Ossining, N. Y..... C B . .
Ideal. See Driver Harris Wire Co.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... C . . S
Indiana Steel & Wire Co., Muncie, Ind. .... S
Inland Wire & Cable Co., Sycamore, Ill..... C . . .
Karma. See Driver Harris Wire Co.
Keystone. See Fullman Mfg. Co.
Lucero. See Driver Harris Wire Co.
Marion Insulated Wire & Rubber Co., Marion, Ind. C . . .
Monarch Elec. & Wire Co., 622 W. Adams, Chicago C . . S
Monex. See Standard Alloy Wire Co.
National-Harris Wire Co., 113 Orchard, Newark.. . . B . .
Nehring Electrical Works, De Kalb, Ill. ..... C . . .
Nichrome. See Driver Harris Wire Co.
Novar. See Standard Alloy Wire Co.
Page Steel & Wire Co., Bridgeport, Conn..... . . S
Paranite. See Indiana Rubber & Insulated Wire Co.
Peerless. See Alloy Metal Wire Co.
Phillips Wire Co., Pawtucket, R. I. ..... C . . .
Phono-Electric. See Bridgeport Brass Co.
Premier. See Alloy Metal Wire Co.
Providence Insulated Wire Co., Providence, R. I.. C . . .
Race. See Rose Wire Co.
Revolute Wire Co., Hastings-on-Hudson, N. Y.... C . . .
Roebling's Sons Co., John A., Trenton, N. J..... C . . S
Rome Wire Co., Div. of General Cable Co., Rome, N. Y. ..... C . . .
Ross Wire Co., 69 Bath, Providence, R. I..... C . . .
Silerimn. See Valley Narrow Fabric Co.
Seneca Wire & Mfg. Co., Fostoria, O. .... S
Silchrome. See Alloy Metal Wire Co.
Solar. See Gilby Wire Co.
Sparg Wire Co., J. A., Rome, N. Y..... C . . .
Standard Alloy Wire Co., Elizabeth, N. J..... . . B S
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa. ..... C . . .
Super-Insulated Wire Co., Plymouth, Mass. ..... C . . .
Superior. See Alloy Metal Wire Co.
Talking Tape. See Hope Webbing Co.
Therlo. See Driver Harris Wire Co.
Tophet. See Gilby Wire Co.
Tru-Lay. See Page Steel & Wire Co.
Valley Narrow Fabric Co., Falls, R. I.
Wheeler Insulated Wire Co., Bridgeport, Conn.. C . . .

WIRE, Copper Clad

American Steel & Wire Co., 208 S. La Salle, Chicago, Ill.
Copperweld Steel Co., Rankin, Pa.
Standard Underground Cable Co., Pittsburgh, Pa.

WIRE SOLDER. See Solder, Bar and Wire.

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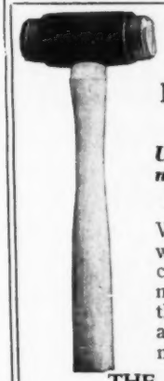
Sleeper-Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., 70 Franklin, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio.
Wire Machinery Corp. of Am., New Haven, Conn.

WIRE, Insulated

KEY

Annunciator, Office, Bell Wire	See A
Asbestos Covered Heater Cord	See H
Asbestos Covered Magnet Wire	See M
Enameled Magnet Wire	See M
Fixture Wire	See R
Flexible Reinforced Heavy Duty Cord	See F
Heater Cord	See H
Ignition Cable	See R
Lamp Cord	See R
Magnet Wire	See M
Rubber Covered Wire & Cable	See R
Stove Wire	See H
Telephone Cord	See T

A-A Wire Co. (Div. of General Cable Corp), 420 Lexington Ave., N. Y. C.. R . . . . . .
A-1 Brand. See American Insulated.
Acme Wire Co., New Haven, Conn.
Enamaled Silk, Cotton .... M
Amelectric. See American Elec.
American Brand. See American Insulated Wire & Cable Co.
American Brass Co., 25 Broadway, New York, N. Y..... A . . M . .
American Copper Products Corp., 233 Broadway, New York, N. Y..... . . . . .
American Electrical Works (Philipsdale), Providence, R. I. ..... M
American Enameled Magnet Wire Co., Muskegon, Mich. ..... M
American Insulated Wire & Cable Co. Div. of General Cable Co., 954 W. 21st, Chicago, Ill. ..... M
American Insulated Wire Corp., Div. of General Cable Co., 45 Baker, Providence, R. I..... R F . . A T . .
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... R F H A T M
Americore. See American Steel.
Amerite. See American Steel.
Amerixe. See American Steel.



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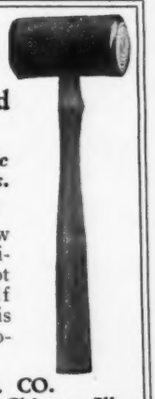
Will transmit an effective blow without damage to the most delicate surface. The blow is not more destructive to the tool itself than to the object to which it is applied—therefore, doubly economical.



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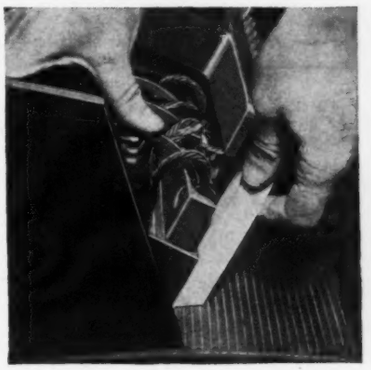

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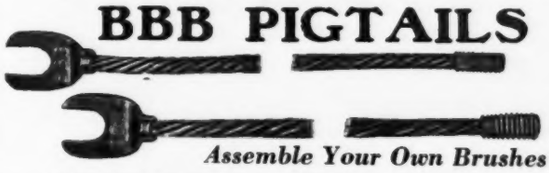

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MANUFACTURERS

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Ansonia Electrical Co., Ansonia, Conn.
Silk, Cotton, Enameled ..... A .. M
Armoriokt. See American Steel.
Bay State Insulated Wire & Cable Co., Paydras (Mattapan), 26, Boston..... B .....
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill. ..... B F H A T M
Beldenamel. See Belden Mfg. Co.
Beldenite. See Belden Mfg. Co.
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. ..... B F .....
Boston Insulated Wire & Cable Co., 65 Bay, Boston, Mass. ..... B F H .....
Bradford, Kyle & Co., Plymouth, Mass. ..... M
Cablex. See Collyer Insulated Wire Co.
Celatsite. See Acme Wire Co.
Collyer Insulated Wire Co., Pawtucket, R. I. ..... B F H .....
Colorbeston. See General Elec. Co.
Condex. See Simplex Wire Co.
Colorubber. See Belden Mfg. Co.
Copperweld Steel Co., Rankin, Pa..... R .....
Cotenamel. See Belden Mfg. Co.
Cottonite. See Acme Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J. ..... B F H A T M
Darow Mfg. Co., 97 Greene, New York, B .....
Davis-Jones Insulated Wire Co., Pawtucket, R. I. ..... B F H A T ..
Deltabeston. See York Insulated.
Detroit Insulated Wire Co., Detroit, Mich. B ..... T ..
Diamond Braiding Mills, Chicago Heights B F H .....
Dreadnaught. See Indiana Rubber Co.
Driver-Harris Co., Harrison, N. J..... B .. H .....
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind..... M
Durabilt. See Tubular Woven.
Duracord. See Tubular Woven.
Durawire. See Tubular Woven.
Duro. See McEvoy, C. H.
Eagle. See Goldmark Co., James.
Eastern Insulated Wire Co., Tilton, N. H. R .....
1885. See Chicago Insulated Wire.
Enamelite. See Acme Wire Co.
Fibrex. See Simplex Wire Co.
Flexible Woven Cable Co., 735 Boylston, Boston, Mass. ..... F .....
Flex-O-Cord. See Packard Elec. Co.
Garco. See General Asbestos Co.
Gavitt Mfg. Co., West Brookfield, Mass. ..... T ..
General Asbestos & Rubber Co., Charleston, S. C. ..... H .....
General Elec. Co., E. M. 12, Merchandise Dept., Bridgeport, Conn..... B F H .... M
Giant. See Collyer Insulated Wire.
Goldmark Co., James, 83 Warren, New York, Annunciator and Asbestos, Cotton, Silk and Enameled Magnet ..... A .. M
Goodyear Rubber Insulating. See Graybar Electric Co.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y. R ..... T ..
Grimshaw. See New York Ins.
Hatfield Rubber Wks., Inc., Hillside, N. J. R .. H .....
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.... R F .. A .. ..
Holyoke Co., 621 Broadway, New York.. R ... A .. M
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... B F H .....
Inland Wire & Cable Co., Sycamore, Ill. R W .. A ... M
I. X. L. See Collyer Insulated.
Kable. See Safety Cable Co.
Kenrite. See American Insulated.
Kerite Ins. Wire Cable Co., 30 Church, New York, N. Y. ..... R .....
Kilo, Co., 2 E. 23d, New York..... T M
Koelle, Frederick C., Real Estate Trust Bldg., Philadelphia, Pa. ..... T ..
Liberty. See Nat. Metal Molding.
Lowell Insulated Wire Co., Lowell, Mass. R F H .....
Lorsteel. See Hazard Insulated Wire Works.
McEvoy, C. H., Lowell, Mass..... R ..... T ..
Maring Wire Co., Muskegon, Mich. Cotton, Silk, Enameled ..... M

Marion Insulated Wire & Rubber Co., Marion, Ind. ..... R F H A T ..
Massachusetts Elec. Mfg. Co., West Lynn, Mass. ..... M
Monarch Elec. & Wire Co., 622 W. Adams, Chicago, Ill. ..... A .. ..
Montgomery Co., J. R., Windsor Locks, Conn. ..... T ..
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa..... R F H A T M
N. E. See Goldmark Co., James.
New England Wire Co., Westfield, Mass.. R .. H .. T ..
New York Insulated Wire Co., 114 Liberty, New York, N. Y. ..... R .....
Nitro. See Belden Mfg. Co.
O. K. See Phillips Wire Co.
Okonite Co., Passaic, N. J..... R .....
Ozex. See Simplex Insulated Wire
Packard Electric Co., Warren, O..... R F .....
Parac. See Phillips Wire Co.
Paracore. See U. S. Rubber Co.
Parafiex. See Bishop Wire & Cable.
Paranite. See Indiana Rubber.
Parkerite. See Seward Wire Co.
Peco. See Packard Elec. Co.
Philadelphia Insulated Wire Co., 200 N. Third, Philadelphia, Pa..... H A T ..
Phillips Wire Co., Pawtucket, R. I..... R .....
Provident Insulated Wire Co., Providence, R F H A ....
Raven Core. See New York.
Reliance. See American Steel.
Rockbestos Products Corp., Nicoll & Conner Sts., New Haven, Conn..... R .. H .. T M
Roebling's Sons Co., John A., Trenton, N. J. ..... R F H A T M
Rome Electrical Co., Rome, N. Y. ..... M
Rome Wire Co., Rome, N. Y..... R F H .. T M
Ross Wire Co., 69 Bath, Providence, R. I.. R .....
Runzel-Lenz Elec. Mfg. Co., 1751 N. Western Ave., Chicago, Ill..... T ..
Safety Cable Co. (Div. of General Cable Corp.), New York ..... R F H .....
Salamander. See York Insulated.
Seward Wire Co., Parkersburg, W. Va. R .....
Silkenamel. See Belden Mfg. Co.
Silkenite. See Acme Wire Co.
Simcore. See Simplex Wire.
Simplex Wire & Cable Co., 63 Sydney, Cambridge, Mass. ..... R F .....
Shield. See Ansonia Elec'l Co.
Spiralweave. See Hazard Ins. Wire
Standard Alloy Wire Co., Elizabeth, N. J. .... H .....
Standard Insulated Wire Co., Westfield, Mass. ..... R .. H .....
Standard Underground Cable Co., Pittsburgh, Pa. (Div. of General Cable.) R F H A T ..
Sterling. See Standard Underground.
Sterling Insulated Wire Co., Fall River, Mass. ..... R .....
Strand & Sweet Mfg. Co., Winsted, Conn. ..... M
Super-Service. See Rome Wire Co.
Sweetstrand. See Strand & Sweet.
Tip-Top. See Standard Underground.
Tirex. See Simplex Wire & Cable.
Trenchlay. See Rome Wire Co.
Triangle Conduit Co., Dry Harbor Rd. & Cooper Ave., Brooklyn..... R .....
Tubular Woven Fabric Co., Pawtucket, R. I. ..... R F .....
United States Rubber Co., 1790 Broadway, New York, N. Y. ..... R .. H A T ..
U. S. Royal. See United States.
Varflex Corp., Rome, N. Y. ..... M
Warrior. See American Copper.
Wheeler Insulated Wire Co., Bridgeport, Conn. ..... R F H A T M
White, J. M., 1128 Oliver, Philadelphia, Pa. ..... R F H .. T ..
Whitney Blake Co. See Graybar Electric Co.
Wovenite. See Flexible Woven.
York Insulated Wire Wks. of G. E. Co., 120 Broadway, New York, N. Y..... R .. H .... M

WIRE, Steel Flat
Steel Coating for Armored Conductor.
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill.
Crescent Insulated Wire & Cable Co., 319 N. Oden Ave., Trenton, N. J.
Roebling's Sons Co., John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.

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(See Also Wire Drawing Machines; Insulation Mixers; Taping Machines, Wire; Wire Polishing Machines; Enameling Machines for Magnet Wire; Wire Wrapping Machines; Vulcanizers, Wire Insulation.)
Armoring Machines ..... See A
Braiding Machines ..... See B
Bunching Machines ..... See S
Covering Machines ..... See I
Insulating Machines ..... See I
Insulation Straining Machines ..... See I
Measuring Machines ..... See M
Park Cabling Machines ..... See A
Saturating Tanks ..... See F
Spooling Machines ..... See U
Stranding Machines ..... See S
Tinning Tanks ..... See F
Winding Reels ..... See U
Adamson Machine Co., Akron, Ohio.. I A .....

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Almco-Seward. See American Insulating Machinery Co.
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa. I A .... S U F
Breguet. See American Insulating Machy.
Crescent. See Royle & Sons, John.
Durant Mfg. Co., 662 Buffum, Milwaukee, Wis. ..... M .. U ..
Housatonic Machine & Tool Co., Bridgeport, Conn. ..... I ..... U ..
Minneapolis Elec. & Construction Co., 80 S. 12th St., Minneapolis, Minn. ..... M .. U ..
Nebutteo. See New England Butt Co.
New England Butt Co., 324 Pearl, Providence, R. I. ..... I A B M S U ..
Peerless. See Royle & Sons, John.
Royle & Sons, John, Paterson, N. J. I .....
Sleeper & Hartley, Inc., Worcester, Mass. ..... A .... S U
Terkelson Machine Co., 326 A St., Boston, Mass. ..... M .....
Textile Machine Works, Reading, Pa. .... B .....
Universal Wire Machy. Co., 69 Daggett, New Haven, Conn. ..... A ..... U F
Utility Mfg. Co., Cudahy, Wis..... I .....
Wardwell Braiding Machine Co., Central Falls, R. I. ..... B .....
Watson Mfg Co., Paterson, N. J.. I A .. M S .. F
Wire Machinery Corp. of Am., New Haven, Conn. ..... M S U ..
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Boxes. See Cabinets & Boxes, Wood
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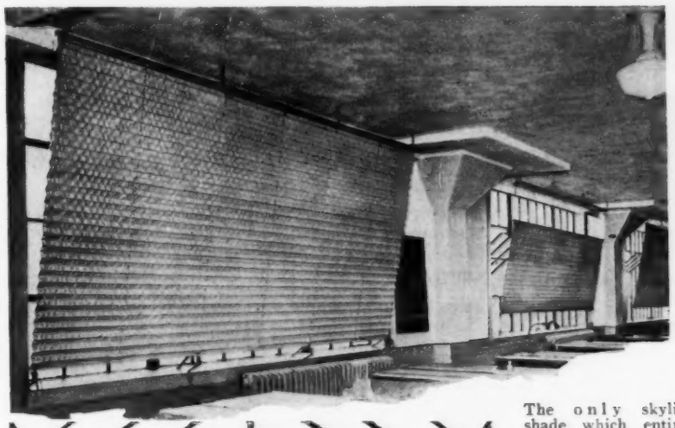

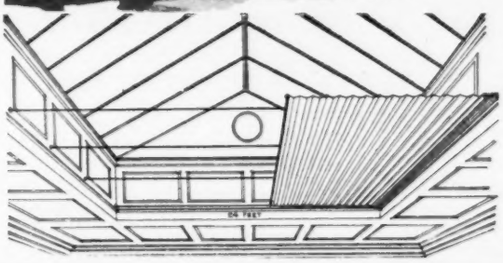

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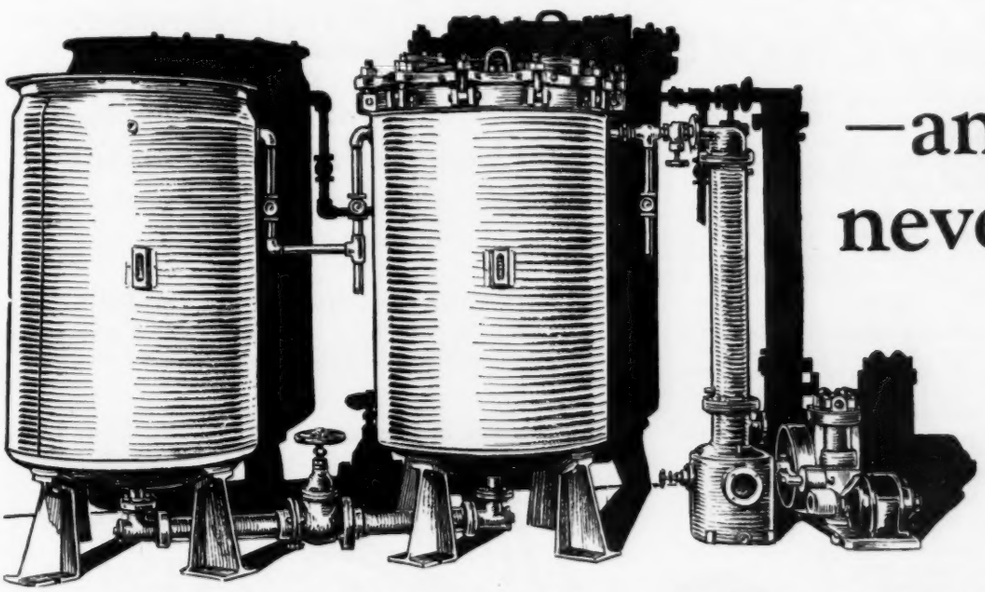

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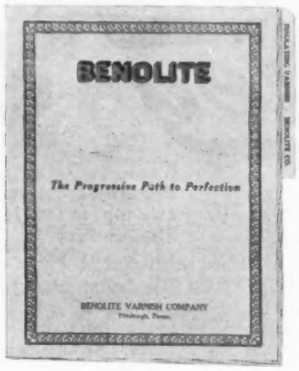

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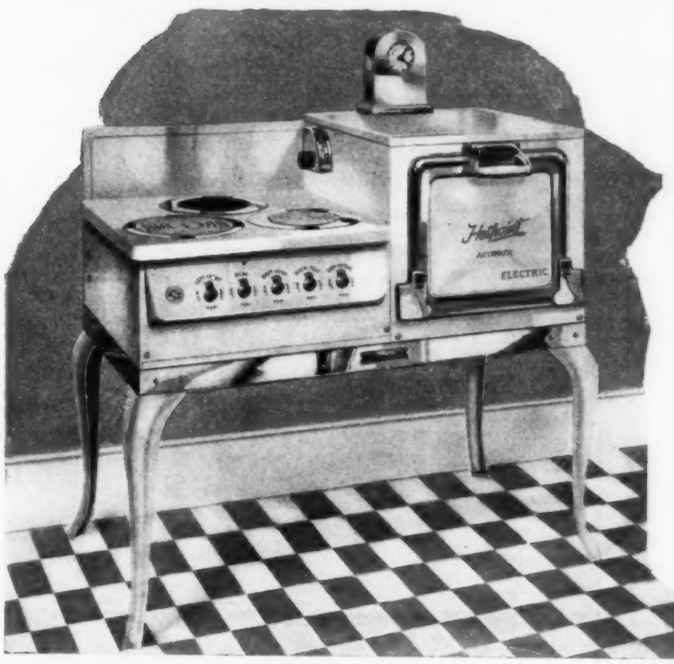

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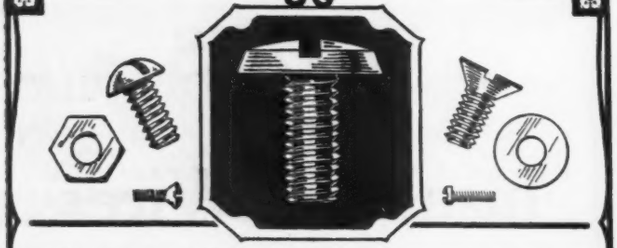

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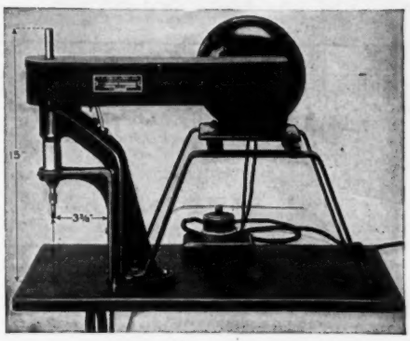

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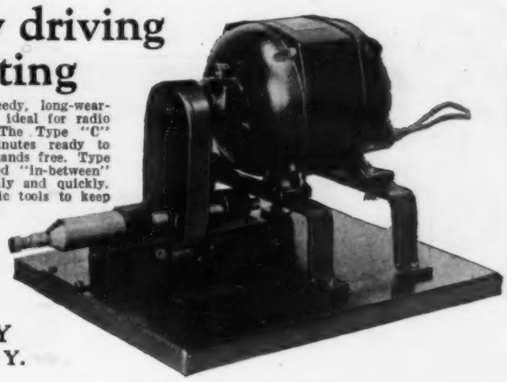

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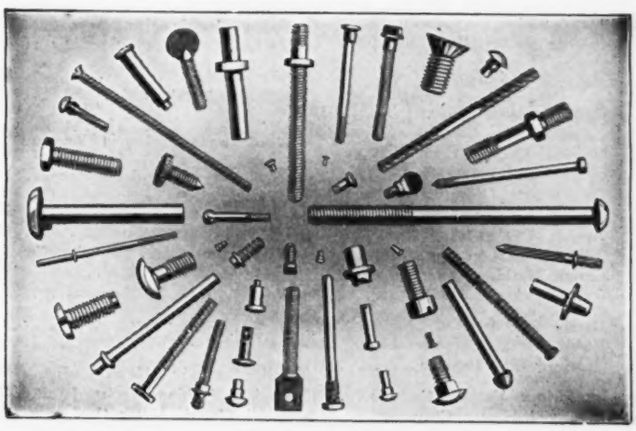

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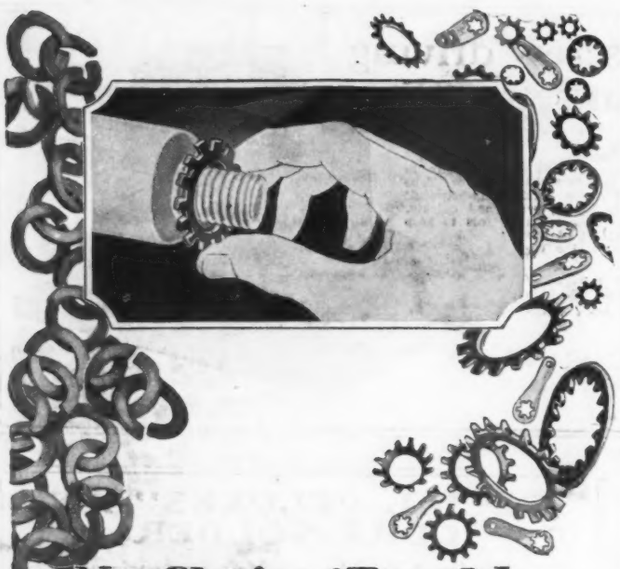

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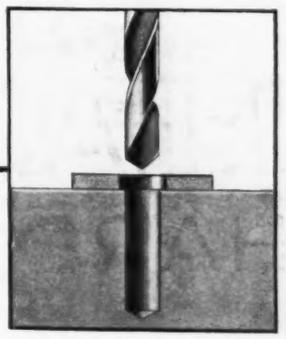

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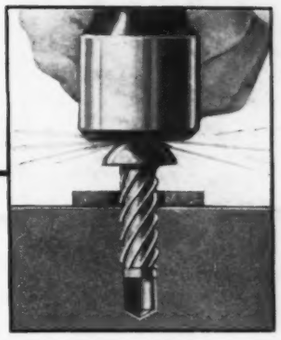

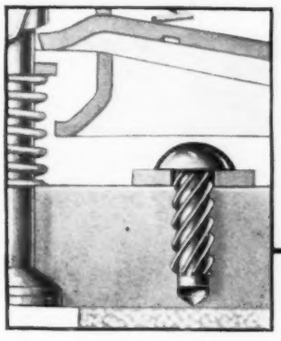

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